THE
ELECTRICAL REVIEW.

VOL. LXXV. DECEMBER 18, 1914. No. 1,934.

ELECTRICAL REVIEW.

Vol. LXXV.] CONTENTS: December 18, 1914. [No. 1,934.

	Page
Miners' Safety Lamps	805
A Board of Trade Electrical Exhibition	806
The Situation of the German Electrical Industry	806
Rubber	806
Foreign Supply Works in Belligerent Countries	807
Over-Pressure Protective Gear for High-Tension Circuits, by K. Edgcumbe (*illus.*) (*concluded*)	807
Power Plant Testing, by W. Selvet (*illus.*) (*concluded*)	809
Electricity in Mines (*illus.*)	811
War Items	813
New Electrical Devices, Fittings and Plant (*illus.*)	814
Correspondence—	
German Agencies	816
American Activity in the Australian Market	816
A Stereopyrometer Wanted	816
Legal	817
Business Notes	818
Notes	823
City Notes	825
Stocks and Shares	827
Electric Tramway and Railway Traffic Returns	828
Recent Advances in Electrical Crane and Lift Design (*illus.*)	829
Calculations Relating to Electrical Conductors	831
Electrical Accidents in Mines for the Year 1913	832
Trade Statistics of Switzerland	834
New Patents Applied For, 1914	836
Abstracts of Published Specifications	836
Contractors' Column ... Advertisement page	xviii

THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C.

Telegraphic Address: "AGENKAY, LONDON." Code, A B C.

Telephone Nos.: Holborn 983; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, 19s. 6d.; Canada, £1 1s. 8d. ($5.30). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND, N.Z.: Gordon & Gotch, Albert Street; The Mining and Engineering Review, 31A, Strand Arcade, Queen Street.
BERLIN: Asher & Co., Unter den Linden; Speyer & Peters, Unter den Linden 49, N.W. 7.
BRISBANE: Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.
DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.
JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c.: Central News Agency, Ltd.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: The Mining & Engineering Review, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place.
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto 1° 307.
SYDNEY: The Mining & Engineering Review, 273, George Street; Gordon and Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street.
WELLINGTON, N.Z. Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

THE UNIVERSAL ELECTRICAL DIRECTORY

(J. A. Berly's).

1915 EDITION

IN PREPARATION.

H. ALABASTER, GATEHOUSE & CO.,

4, Ludgate Hill, London, E.C

MINERS' SAFETY LAMPS.

THE rivalry between the electric safety lamp and the oil "safety" lamp has lately given rise to a great deal of discussion at meetings of mining engineers and managers. In this field we are witnessing a repetition of the process which has already been observed in the struggle between electricity and gas for ordinary lighting, heating and cooking; in the early days the advocates of the older agent, watching the gradual development of its young rival, were at first contemptuous of its qualities, and contented themselves with emphasising the drawbacks of the new-comer and the superior advantages of their own commodities and apparatus. But youth will be served, and the growing importance and appreciation of the electrical methods soon compelled the enemy to bestir themselves and to set about devising improvements in their own systems, incorporating in their apparatus, as far as possible, the qualities which marked those of the aggressor.

The latter replied with further advances, and, in spite of the remarkable progress thus induced in the gas world, the electric light now reigns supreme in every respect, including that of cost, the electric cooker is not only unexcelled, but unequalled in the quality of its products, and is on a par with the gas cooker in point of cost in many towns, and electric heating, though admittedly more costly, is, nevertheless, becoming exceedingly popular.

So, too, the makers of miners' lamps gave little heed to the growing efficiency of the electric lamp until a few years ago. Now they recognise it as a serious competitor, and they, too, have been spurred on to effect improvements in the oil lamp, which must be ascribed entirely to the advent of the electric type. While the electrical engineer can thus claim to be a public benefactor, by compelling reforms which might otherwise have been delayed indefinitely, it must be admitted that his luck is rather hard. However, he is not downhearted; he knows that he must win in the long run, and already he has many staunch and convinced adherents in the ranks of his customers. Amongst the latter Mr. W. Maurice, once President of the Association of Mining Electrical Engineers, and a manager of some 15 years' experience, has taken a leading part in repelling the aspersions cast upon the electric safety lamp by its enemies. It is alleged, for instance, that the lamp, though nominally giving over one candle, really yields only about $\frac{2}{3}$ C.P., while certain oi lamps of a new type give twice that value, at the end of a shift; also that ignitions of gaseous mixtures have been obtained with electric lamps. But the official specification for the oil lamp only requires it to give 0·3 C.P., showing what the experts think of its capabilities; and the atmosphere in which an ignition was obtained consisted of air and coal gas, which is notoriously more easily ignited than methane.

That the candle-power of the electric lamps has fallen off, and the life of the batteries has been short, at some collieries is true, but the blame is not to be laid upon the

lamp; it is too often the case that the electric lamp room is put in the charge of utterly incompetent hands, with the inevitable result that any electrician would foresee. It is the old story in mining work; we have again and again declaimed against the folly of purchasing expensive apparatus and expecting an unskilled labourer to keep it in first-class working order. That is the root of the trouble in connection with miners' electric lamps, just as it has been in the case of other electrical plant in mines, and until the managers realise that high-class apparatus demands, and must receive, skilled attention, the trouble will continue.

As for the future of the electric lamp, we have no fears. The colliers, once they have used the electric lamp, refuse to go back to the oil lamp, and therein lies the assurance that the electric lamp must win. Moreover, the latter is constantly being improved; the tungsten lamp has come, the half-watt miners' lamp is being perfected, and it will not be long before great strides ahead will be recorded. Moreover, the increased output of coal due to the better lighting benefits both the workman and the owner, and should be credited against the greater cost of the electric lamp, while the reduction or abolition of the cost of compensation to miners afflicted with nystagmus, which is confidently anticipated when the better lighting is adopted, alone will go far to cover the cost of the lamps.

A Board of Trade Electrical Exhibition.

We would urge British electrical manufacturers, traders and others who may have it in their power, to co-operate with the Board of Trade Commercial Intelligence Branch in its efforts to secure the success of the Exhibition of German and Austro-Hungarian electrical manufactures that is now in process of organisation. It is hoped to bring together as complete as possible a collection of electrical apparatus, appliances, accessories and what are generally known as supplies, that have in the past been imported into the United Kingdom from the countries with which we are now at war. Manufacturers have many a time come up against German and Austrian electrical goods that could easily be made in this country, and it lies in their power to ensure that the collection now being got together shall be as representative as possible. We have no doubt whatever that such a display, if complete, could be made most instructive and educative. Manufacturers or their responsible representatives from all parts of the country will do well to consider a visit to London (32, Cheapside, E.C.) to see this Exhibition, one of their definite engagements for early January. We hope to give further particulars later, but in the meantime we urge the matter upon their attention. Buyers must also be induced to gather together to meet the British manufacturers who desire to impress upon them that they are both able and willing to fill requirements for these articles in the future, and we believe that there is a well-organised movement on foot to that end.

The Situation of the German Electrical Industry.

The current statements made by the German newspapers on official authority are in general so extraordinary that they have to be regarded with great caution, if not with considerable suspicion. This contention applies equally well to the electrical industry in that country, which is referred to by the *Reichs-Arbeitsblatt*, published by the Imperial Statistical Board. This Labour organ, which deals with the situation of the electrical industry in October, stated at the beginning of December that although the activity in general is not so good as in the previous year, the workmen at disposal are in part better employed than in 1913, and there is no lack of unskilled labour. Concerning the month of October, the newspaper remarks that a further improvement took place in the construction of accumulators, in which the course of business was already good. It is submitted that confidence continues to return, and that not only are pressing repairs being executed, but extensions and new installations have also been ordered. A revival of business was also noticed in tramway and insulating materials. One of the reports received by the labour organ attributes the improvement in the construction of electrical machinery and apparatus to the additional work provided by army contracts. In the case of measuring apparatus, two works which are specially engaged in this department record a not inconsiderable improvement as compared with the position of affairs in September, and in this instance also it is held that confidence in business has been further strengthened. The reductions in the length of the working day, which were unavoidable for a portion of the workmen at the beginning of the war, are variously reported to have been abolished; overtime is said to be frequent at different works, and in some cases three shifts are worked, but a scarcity of skilled workers exists.

It is further stated that the telephone and telegraph departments were well employed in October, as in the preceding month, in consequence of war contracts and orders given by other authorities. In this connection one large firm is credited with the assertion that not only has business with Government authorities improved, but a revival has also taken place in private business. The rates of wages in the branches in question have gradually been increased by from 10 to 15 per cent. The course of business in the production of apparatus for heavy currents, according to some reports, did not show any alteration as compared with the previous month, although one large firm states that orders for other than army purposes were more plentiful. The supply of unskilled workers in this branch also was abundant, whereas that of skilled artisans was inadequate. After mentioning that the erection of installations for heavy currents did not afford as much employment as in September, the Labour organ states that the branches engaged on cable manufacturing and the production of insulating materials had a satisfactory course of business in accordance with the prevailing conditions, only one firm, which has no army orders, reporting no briskness in trade, although admitting that the inland orders are gradually coming forward. The only comment to be made on the October report is that it is preferable to await the speeches impending at the annual meetings of the manufacturing firms, before accepting the statements made by the Government Labour organ, provided, of course, that the speeches really represent the actual situation of affairs in that country.

Rubber.

Fluctuations in the price of rubber, although not of much daily importance, have on the whole tended in a downward direction, and the tone has been a little easier with plantation first latex crepe at round 2s. 0½d. to 2s. 1d. per pound, and smoked sheets at about 2s. 3d. to 2s. 4d. per pound. Para rubber is still held for comparatively high prices in the neighbourhood of 2s. 9½d. per pound or thereabouts, with trade buying of a quiet character. The importance of the British grown material is growing very steadily, and for November the imports from the Federated Malay States, Straits Settlements and Ceylon were 85,000 centals of 100 lb., while the rest of the world was responsible for only 26,000 centals or so. For the 11 months of this year, British grown rubber was entered in here to the total of 775,000 centals, and rubber from elsewhere to the amount of 565,000 centals. Of the imports last month, which aggregated 112,000 centals, a matter of 88,000 centals were exported. This seems to betoken the reserving of but moderate quantities for British home trade, and this being the case there can hardly be much accumulation of stock going on. Of the exports, 66,000 centals went to the United States and 10,000 centals to Russia. The total exports for the 11 months were 1,064,000 centals, of which more than half went to the United States. There is every reason to believe that Germany is getting hard up for rubber, but less is being heard of the attempts of her agents to obtain supplies by tortuous means from here and elsewhere. The export prohibitions now in force act as a strong line of defence against the efforts of the Huns to obtain supplies of one of the essentials of modern warfare, and there is not the smallest likelihood of there being any relaxation of condi-

tions which are necessary to the well-being of ourselves and our allies. The fact that the British Empire produces something like 70 per cent. of the world's output of plantation rubber has by this time been brought home with crushing force to Germany. Germany of course robs and plunders wherever her troops set their feet, hence the scouring of Antwerp and, indeed, all the cities they have laid waste for rubber to be sent into Germany to replenish their sore needs. From information received, too, it is believed that they have plundered a quantity of rubber and ivory awaiting shipment in the French Congo, though what they can do with it, there is a mystery. They cannot eat it and they cannot ship it.

There has been some heartburning in America over the embargo placed upon exports from here by the British Government, for it was early recognised that the United States trades must suffer considerably unless the usual supplies of rubber were forthcoming. Failing these coming to hand, America would have to rely upon Brazil, which country exports about 40,000 tons of wild rubber a year, of which normally rather less than half goes to New York. The position appears to be easier in some respects now, and with consumption here active and a good deal being done by France and Russia, the market outlook contains certain favourable factors.

According to an official cablegram received from Kuala Lumpur by the Malay States Information Agency, the export of cultivated rubber from the Federated Malay States in the month of November amounted to 2,889 tons. The October export returns are, however, not yet to hand.

Foreign Supply Works in Belligerent Countries.

The existing state of war, taken in conjunction with the presence of a foreign electricity supply works in the city, induced the Moscow City Council a short time ago to appoint a special Committee to investigate the question of the relations between the Moscow supply works of the St. Petersburg (Petrograd presumably in future) Electric Lighting Co., of 1886, and Germany. As a result of the inquiry the Committee is said to recommend the sequestration of the local undertaking on the grounds that the majority of the shares are held by German-Swiss banks, that the working of the Moscow undertaking is technically dependent upon Berlin and that not a single penny out of the last large issue of shares made on behalf of the company by the Deutsche Bank has reached Russia. It appears that the Electric Lighting Co., of 1886, has a share capital of £5,000,000, in which the Petrograd works are represented by a book value of £1,908,000, the Moscow works by £2,474,000, and the works at Lódz by £793,000. In German interested circles the action of the Moscow Committee, which would be subject to the approval of the City Council, and would, it is assumed, also require the confirmation of the Ministry in Petrograd, is conceived to imply not an expropriation of the undertaking, but the suggested appointment of a committee to supervise the works so as to prevent any efflux of money to Germany, under existing circumstances. The allegation that none of the money realised on the last emission of shares was sent from Berlin to Russia is denied in Germany, where it is pointed out that the Teutons naturally retained the amount of the contract prices for the machinery and materials supplied for Moscow, and a portion for dividend payments, but that funds were remitted for the payment of taxes, salaries, wages, &c. The question now arises whether, as is conceivable, the Petrograd City Council will follow the example of that of Moscow. At any rate, the present case shows how the Russians are beginning to perceive the effects of German supply promotions in Russia, even when supported by German-Swiss financial institutions, one of which in the instance in question is very closely related to German manufacturing companies; whilst the result of the practical German monopoly of electrical manufacturing in Russia is another factor which will undoubtedly receive further consideration in the near future.

OVER-PRESSURE PROTECTIVE GEAR FOR HIGH-TENSION CIRCUITS.

By KENELM EDGCUMBE, M.Inst.C.E.

(*Concluded from page* 777.)

Having decided upon the form of spark gap, the question still remains of the resistance to be connected in series with it. The best value for such a resistance has been the subject of much discussion. It has been said, on the one hand, that unless it was of the order of 500 ohms or less the protection afforded was small, and that, on the other hand, if such low resistances were used oscillations and pressure rises would be set up.

The experiments of Schrottke, already alluded to, show conclusively that with the horn arrester, at any rate, no such rise need be feared, even with a much lower resistance than is advisable from other points of view. When an arrester is discharging the resistance is connected directly between the line and earth, and too low a resistance is clearly undesirable. On the other hand, experience has shown that a resistance of from ½ to 1 ohm for each volt of line pressure affords ample protection in the case of a cable system, and of say 0.1 ohm for each volt in the case of an overhead system.

It has sometimes been put forward as an advantage of the multi-gap, electrolytic and other quick break arresters that resistances of much lower heat capacity can be employed with them, since the circuit is opened much more rapidly, usually within half a period, so it is claimed. This is of little practical value, however, since in the event of a continued disturbance a number of successive discharges will take place before the over-pressure is relieved. It has been shown, moreover, that a further half period must elapse before the gap can again discharge.

The remarks made earlier, when dealing with resistance suitable for use against atmospheric discharges, apply equally in the present case. In fact, the question is an even more serious one, since the discharges due to internal disturbances, although usually less severe both as regards steepness and energy, are often of much longer duration. Hence the absence of liquids liable to evaporate and of inflammable oil is clearly indicated. Moreover, carborundum rods with their liability to disintegrate under continuous discharges are out of the question for all except the least important positions. The Brazil horizontal pattern of carbon powder resistance would therefore appear to be about the only one left.

Fig. 13 shows this resistance in fire-clay slab. Its general construction is similar to that of the atmospheric discharger already described (see fig. 8), except that it is unnecessary that the path should be kept straight in this case, and as the resistance required is higher, a zig-zag form of groove is employed. Fig. 12 shows the horn discharger and resistance slabs suitable for a 12,000-v. system. For higher pressures the number of slabs in series is increased in proportion. The slabs themselves being fireproof and constructed of insulating material, no special precautions are necessary as regards erection; in fact, in most cases they can be placed direct on the floor.

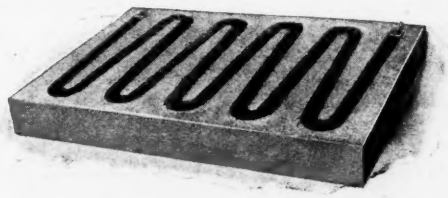


Fig. 13.

General.

Since prevention is always better than cure, it is essential that sources of possible over-pressures should be eliminated as far as ever possible. For this reason, in designing a system not only must the length, capacity and self-induction of the line and generator be considered, so as to eliminate resonance, Ferranti effect, etc., but care should be taken to avoid the placing of switches in such positions that they will have large capacities on either side of them, further, small machines at the end of long lines should be avoided, and so forth.

It is also essential that such over-pressures as do occur should have their origin quickly located, so that they may be eliminated in their early stages and before they become serious. To this end some form of over-pressure detector should always be installed at different points of the system, so that the ramifications of any over-pressures may be followed. Such an indicator, as designed by Mr. Brazil, is shown in fig. 14. B R represents a Brazil resistance

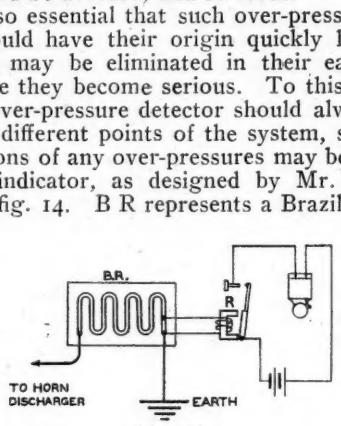


Fig. 14.

slab connected between discharger and earth. In parallel with a short length of the powder is a relay R, and so soon as a discharge occurs a current passes through the resistance to earth, the relay acts closing the local bell circuit and thus draws the attendant's attention to the fact that an over-pressure has been dealt with. Instructions should be given that particulars of every such occurrence are to be at once entered up, together with any details of plant running, switching operations in progress, or other factors likely to be of use in locating the source of trouble.

In order to make such indicators available in substations where there is no attendant, the bell can be supplemented or replaced by a graphic instrument, and a permanent record thus obtained of the moment at which an over-pressure occurred. Such over-pressure indicators and graphers have proved of great value by giving warning of incipient faults and sources of over-pressure before they became serious.

The "earthing" arrangements are a very important feature of all over-pressure protective systems. If an earth wire is employed on an overhead line this should be efficiently earthed at intervals. For this purpose an earth plate some 18in. square, buried in coke, will be found convenient.

For earthing at the station, either earth plates or tube electrodes can be used. When the ground is naturally fairly moist, non-corrodible plates some 5 sq. ft. in area buried vertically, with not less than three feet of soil above them, will be found to meet most cases. If the ground is dry 1in. or 2in. gas barrel 6ft. or 8ft. long driven vertically into the ground and filled over and over again with salt and water, can be employed. At least three such pipes should be connected in parallel. In many cases good earth connections can be made to structural metal buried in the ground. Metal in concrete is, however, useless.

Conclusions.

Briefly summarising the conclusions arrived at, it may be said:—

1. As a protection against static charges, all long overhead lines in exposed positions should be provided with "permanent leak" inductive resistances.

2. On all overhead or partly overhead systems plant should be protected by line choking coils.

3. As a protection against steep-fronted waves due to lightning, condensers can be used, but they are expensive and are of no use as a protection against any other form of disturbance, whether on overhead or underground systems.

4. Consequently, if condensers are used at all they must in all cases be supplemented by some form of discharge gap capable of dealing with other forms of disturbance.

5. Discharge gaps installed in conjunction with line choking coils are quite capable of dealing with disturbances of both kinds, so that the extra cost of installing condensers is seldom justified.

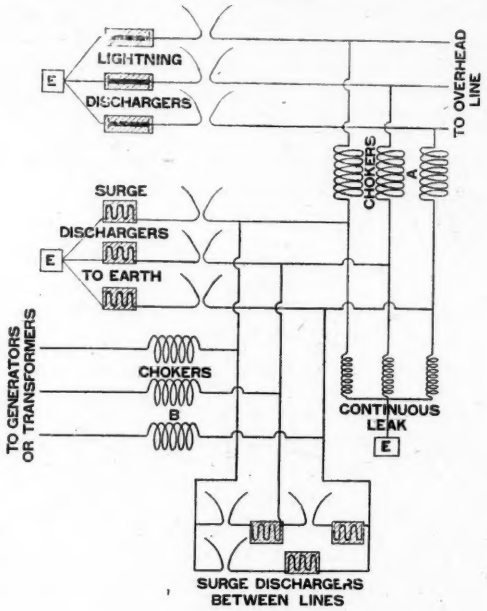


Fig. 15.

6. The discharge gap must not break the circuit too suddenly, and should be sufficiently robust to allow of its being connected directly to the line without the interposition of a fuse. The horn discharger best fulfils these requirements.

7. When acting, the discharger must not constitute a dead earth or short circuit, and must therefore have a limiting resistance in series.

8. The limiting resistance should be robust, non-inflammable, unaffected by heat or frost, not liable to deterioration under long or recurring discharges,

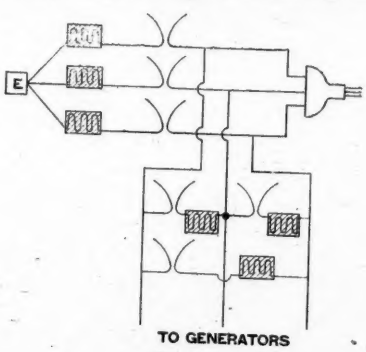


Fig. 16.

and should require no attention over long periods. The Brazil form of carbon powder resistance best fulfils these requirements.

9. The ohmic value of the resistance must be high enough to prevent undue disturbances to the system and low enough to afford relief to the line. One ohm per volt for cable systems and 0.1 ohm per volt for overhead systems has been found to meet practical conditions in every way.

10. For lines subject to atmospheric disturbances the path to earth should be as straight as possible

(fig. 8), and even for cable systems should be reasonably non-inductive (fig. 13).

11. With properly proportioned protective gear internal surge discharge gaps may be set as low as 50 per cent., and atmospheric disturbance gaps from 100 per cent. to 200 per cent. above the line pressure.

12. On insulated systems internal disturbances normally arise between lines, and the dischargers should be connected accordingly. At the same time it is best not to dispense with the earthed arrester on this account (see fig. 16).

13. Discharge indicators, with or without graphic attachments, should be installed at various points on the system.

Fig. 15 shows the connections for a complete set of protective gear for an overhead system or one partly overhead and partly underground. Fig. 16 gives the connections for an entirely underground system with insulated neutral. The three earthed arresters may, in this case, be omitted, although this is not recommended. If the neutral point of the generator is earthed the dischargers between lines can be dispensed with.

POWER PLANT TESTING.

By W. M. SELVEY, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers, *November 26th*, 1914.)

(*Concluded from page* 804.)

It is advisable that one boiler of a type should be set aside for testing work, and fitted up with measuring instruments. A sample truck or trucks of coal can then be run through the grates, and the actual evaporation measured. For ordinary commercial working the special boiler is by far and away the most effective calorimeter.

Fig. 4 shows an arrangement of tanks and weighbridge which has been found convenient for power-station work. By

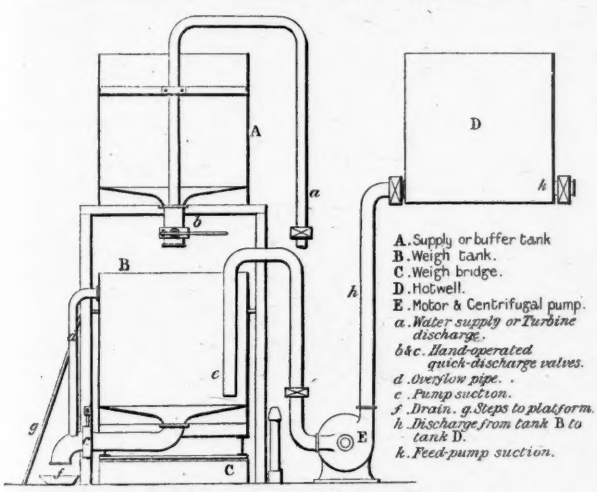


Fig. 4.—Arrangement for Water Measuring.

reversing the order of use and omitting the pump, it becomes of equal service for turbine testing.

For contractors' tests the author suggests for a standard practice that the boiler should be tested three days after being swept; the interior of the tubes being reasonably clean at the time, say not more than 1/32 in. of scale, the boiler to be on full load eight hours before the test starts, and during the last two hours to be fed with spare test coal, during which the thickness of fire may be adjusted. After starting on the weighed coal, the thickness must not be altered, any regulation being done on the speed of the grate.

Turbines and Generators.

As regards the steam end of the plant, measurements of the temperature of the steam have been greatly improved, both by the use of the Whipple indicator and by a specially adapted form of thermometer.

As regards pressure measurements, large pressure gauges are very satisfactory if used immediately after being checked on a "dead weight" tester. Highly reliable test gauges are also supplied by leading makers. In most cases this measurement is not of great importance, but in certain cases where defect in pressure reduces the output of the plant it becomes of first importance. The vacuum should be measured at the exhaust flange of the turbine—a difficult but most important measurement. The author has found it necessary to have a special aneroid barometer made.

The measurement of the condensed water offers little difficulty, thanks to the manufacturers of weighbridges. The accuracy of these can be easily made better than one in a thousand (0.1 per cent.), which is the ideal that the author thinks ought to be aimed at in each individual measurement in turbine testing if the final figure is to have anything like an absolute accuracy of 1 per cent.

The tank and the electrical meter measurements should be absolutely correlated by bell, light, and telephone signals, without the intervention of the time element at all. It should be purely a measurement of matter against energy.

Electrical Meters for Generator Outputs.

(*a*) *Continuous Current.*—Owing to the temperature coefficient of almost all large continuous-current watt-hour meters, it is a better policy to use precision voltmeters and ammeters except with extremely variable loads. It is well to re-check any instrument against its test-room calibration, by means of a potentiometer and standard cell, when the instrument is actually *in situ*.

The main shunt should be designed and fixed with more insight than is usual with shunts for ordinary switchboard instruments. Errors due to change of resistance, unequal heating, and thermo-electric effects, are quite appreciable if the temperature approaches 85° F. It is well to arrange to include thermometers inside test instruments, the bulb being placed close to the actuating part. Without excessive pressure-drop in the shunt the temperature coefficient of these instruments is likely to be more than 0.03 per cent. per 1° F.

(*b*) *Three-phase Current.*—It is the author's opinion that the only satisfactory method is to take in duplicate the whole set of pressure transformers, current transformers, leads, and meters, to the National Physical Laboratory—or, say, the Manchester University—before a test, and have them thoroughly checked, and then tally every lead on breaking circuit. All the gear should then be brought by hand to the user. The meters should be mounted in a remote control room, quite cool and free from vibration, the length and section of the leads having been pre-arranged to allow for this. By following this method results have been obtained that are quite consistent with the ideal 0.1 per cent. in regard to the comparative behaviour of two complete and independent sets of meters and transformers. Efficiency tests should always be run on unity power factor unless there are serious reasons for the contrary.

In turbine testing no measurement can under the best conditions yield happier results, or on the other hand more serious discrepancies. In a recent case within his own experience, a station engineer proposed to reject entirely a turbine plant on results obtained by using the mean reading of three meters which differed 7 per cent. among themselves.

Condensers and Air Pumps.

It is almost impossible to arrive at any just appreciation of a condenser performance without knowing at the same time the air leakage with which the air pump is dealing and the rating of the pump. In this direction the Scanes gauge will be a great educating force.

But for the unavoidable cooling of the condensate and the upkeep of reciprocating machinery, in no respect can the combination of a Parsons augmentor and an Edwards air pump be surpassed in reliability or capacity to-day, neither is there any other system so low in its power requirements. In spite of this they are seldom fitted to newer plants. This seems to be a most striking example of reciprocating plant being superseded by rotary plant.

The ability of a steam jet to handle large volumes of gases is unequalled, and the author thinks that the ultimate type of air pump will be a steam augmentor jet in series with a pump of the Kinetic or Leblanc type.

Air leaks occur, even in the best-regulated stations, at expansion joints and even the main casing joint.

In order to test the air pump it has now become usual to disconnect it from the condenser and to admit to its suction various amounts of air as measured by the in-draught, through calibrated nozzles. This is quite a fair test in comparing air pumps, but unless the air so drawn in is thoroughly saturated after expansion with water vapour at the temperature of the water used by the pump, it is not safe to assume that the pump would produce the same vacuum when actually attached to the condenser and dealing with the same amount of air.

To include provision for occasional leaks, the author would suggest that provision should be made for at least 1.3 lb. of air per 1,000 lb. of steam for plants of moderate size, and for 1 lb. per 1,000 lb. with large plants. Under these circumstances the vacuum maintained by the air pump when dealing with this amount of air, but disconnected from the condenser, should be within 0.3 in. (mercury) of the vapour pressure of the water that it is using.

The performance of the condenser depends almost entirely on the steam distribution. The buyer should specify the sur-

face that he requires, especially if he is at all troubled with dirty condensing water; in this case it is well to arrange for 1 sq. ft. of surface for every 5 lb. of steam to be condensed per hour.

The author suggests, as a standard for testing, that a condenser having 1 sq. ft. of surface for 7lb. of steam, and a water velocity of 6 ft. per second through the tubes, together with the air pump already described, should be expected to have, three days after brushing the tubes, a value of "K" not less than 450. The onus of making the plant airtight would thus be left on the contractor. By "K" is meant the number of B.Th.U. transmitted per square foot of surface per hour per degree (Fahr.) mean difference between the temperature inside and outside the tubes, the temeprature outside being assumed to be uniform and measured at the inlet, and the water temperature to be the mean of the inlet and outlet temperatures. These temperature measurements are to be combined with an accurately calculated figure for the heat per lb. of steam condensed, which with modern plants is often found to be between 970 and 980 B.Th.U. per lb. of original steam.

Cooling Towers.

Considering that a difference of 1° F. in the temperature of the cooling water means about 0.3 per cent. in the consumption of the turbine plant, and bearing in mind the value of 1 per cent. as shown in the introductory remarks, it would seem to be a mistake to try and cut down the height of the chimney, since cooling towers are so cheap.

As regards the testing of cooling towers, very great care is necessary in taking the wet and dry-bulb temperatures. Delicate open-scale thermometers are used, and must be shielded from radiation and yet have a free stream of air passing over them. The radiation from the observer's face is quite sufficient to vitiate a reading that is not taken promptly.

The thermometers should be to the windward of the tower, and in the shade if possible. The observer should always keep to leeward when reading, and the stand should be watched all the day to see that no change of wind or bright sunshine can in any way affect the correctness of the readings.

The only fair way to take the temperature of the water before and after cooling is on the condenser inlet and outlet pipes. It is possible to get all sorts of temperatures by floating a thermometer on the surface at the base of the tower.

It is difficult to measure such large quantities of water as are cooled in towers, say, up to 250,000 gallons per hour. It can be done by a Venturi meter, or weir. Alternatively, it is much better done by the thermal method, in which the amount of water is calculated from the measured condensate, its known loss of heat per lb. in the condenser, and the rise of temperature of the circulating water. This test properly run is of considerable accuracy.

In testing large water turbines, a steady stream of concentrated salt solution is added to the incoming water, and the tail-race water is analysed for salt. The same principle is commonly used for finding condenser leakage where the circulating water is salt, and removes the necessity on a turbine test for having the condenser absolutely watertight.

Centrifugal Pumps.

It is seldom that a test of a circulating pump is required in power-station work. It seems to be a common mistake with these pumps to use too small a motor and too large an impeller. It is rather unfair to the motor, and an early test of the amount of power taken is always advisable.

The water leaving the pump has appreciable kinetic energy, part of which can be converted into head by an expanding nozzle. The specification should say whether the efficiency is to include this regained energy.

Fans.

It is seldom that fans have an efficiency much above 65 per cent., and the means of testing them have not been highly developed for ordinary commercial use. In the author's opinion the best way to test them is to discharge the air through a set of home-made wooden nozzles of suitable size which can be fitted in turn on the outlet of the fan.

The efficiency of fans will receive close attention in the future. In order to make the boiler as flexible as the turbine, condenser, and alternator, much greater fan power will be used, and the draught used will probably rise to 6 in. water gauge.

General Remarks.

The organisation of the personnel for accurate testing is a matter for concern. In no case is it advisable to undertake any permanent testing work unless there are at least three engineers, or two engineers and a chemist, in constant collaboration with each other.

In arranging a test it is advisable to have full instructions typed out and handed to every person engaged in a trial; and even then it is necessary to make certain that these instructions are read. The author has almost entirely abandoned sound signals in favour of lights, although sometimes a powerful hooter is a welcome assistant in a big station.

It is his practice to take all readings in triplicate, and in case of very important trials to have one power-station man and one contractor's man to take each particular set of readings in conjunction, so that any disagreement may be dealt with at the time and on the spot.

It is only fair to the contractor to allow the turbine that has to be tested to run for a considerable length of time before commencing the test, so that in such matters as the warming-up of the casing and the heating of the oil in the bearings, steady conditions may be obtained. The author always recommends at least an hour's interval between the tests at half, three-quarter, and full load, the load being increased to the higher rating immediately after the finish of the previous run. It is very seldom except in the case of jet condensers that any further accuracy is obtained by running for longer than one hour. He has been able to reproduce the consumption hour after hour on a certain turbine without a variation of more than one or two parts in a thousand. Corrections should be avoided if possible, and by judicious working of boilers, and by testing at such time of the year that the vacuum producible is superior to that on which the turbine guarantees are based, it is nearly always possible to adjust the conditions so that the corrections do not amount to more than 1 per cent.

It is very important that the condenser should be tested for tightness on the water side. The method favoured by the author is that when the brushing of the condenser tubes is finished the inside of the condenser should be filled up with fresh water on the steam side to as high a level as possible. This serves the double purpose of actually indicating the leaking glands or perforated tubes, and at the same time revealing any small air leaks that there might be in the casing. Very satisfactory results can be obtained by this method.

From the personnel point of view it is unwise to carry on the test as a whole too long, for there is a remarkable connection between the fatigue of the observers and the accuracy of their recorded observations. For this reason attention should be paid to their physical comfort during the test.

Certain makes of turbine show quite 5 per cent. better results if tested immediately they are put into service than after a year's running, while some show no change whatever. The author thinks it would be fair to say that the turbine must run six months on commercial load before being tested; and the contractor should be then allowed 48 hours to open out and examine the machine in preparation for the test. Alternatively, the specification may state that the machine must be tested as soon as it is on commercial load, and again at the end of its year of maintenance, not showing more than, say, 3 per cent. decrease in efficiency at the end of that period.

If the blades are covered with an appreciable deposit of lime it is inadvisable to test the machines without giving the contractor the option of cleaning them, since this deposit is in no way due to the turbine. It depends on the way the boilers are being run. A standard clause containing some such conditions of test might be embodied with advantage in all specifications. The time suggested for preparation is not sufficient to execute any large repairs that might be found necessary, and in any case such repairs would give rise to questions quite outside those relating solely to the efficiency test.

In conclusion, the author hopes that he has suggested grounds for the following points:—

The equity of exceedingly careful testing of modern plant.
The equalising of conditions under which these tests are run.
The value of the data gained from tests for routine operation.

Discussion in London.

Mr. R. A. Chattock, in opening the discussion, dealt with the principle of power plant testing. It was of the utmost importance that all testing should be carried out with accuracy and reliability, and this required trained observers, who, though they might be found in large stations, were not usually available in the small ones, which formed the large percentage. It was usual for the small station to rely on the contractor for men to carry out tests, and as these must naturally be interested it was not altogether a satisfactory arrangement. Even in large stations, experts were really required, because the ordinary station staff had sufficient work to occupy its time. The testing was not of much use unless the specified guarantees were clearly set out; there was a great divergence in specifications which must cause considerable difficulty to contractors in carrying out tests. The specification should be drafted on a recognised basis, or it would be useless to call in an independent engineer and pay his fee. Although it was usual to ask the contractor to supply testing apparatus, he thought it would be better to install such apparatus permanently in the station, and that the Engineering Standards Committee should be asked to specify such standard apparatus. The corrections for steam pressure, vacuum, etc., should be specified to facilitate the work of the testing engineer; it was also absolutely necessary to ask the contractor for cooling towers to submit a series of curves showing the performance of the tower under varying conditions. To obtain the desired result it required those who drafted the specification to have as much knowledge as the testing engineer.

Mr. C. C. Paterson said he was glad to see recognition given to the connection between high accuracy of testing and cost, but he thought possibly it would be rather difficult to obtain the electrical accuracy suggested, which was, he considered, the limit. It was a question whether the instruments would maintain their constancy, but a high degree of accuracy could be obtained if precaution was taken. There were many links in the chain connecting the fundamental standards and the large power meter to be calibrated, and the most scrupu-

lous care would be necessary to ensure accuracy. Errors of several per cent. would creep in unless meters were tested with their transformers, and there was a very strong case for doing this. It was most fallacious to test three-phase meters on single-phase circuits, and it should be a rule to test them with three-phase circuits.

Mr. Robt. Hammond, referring to the question of bonuses and penalties, said he believed he was the first consulting engineer to correct a contractor's verbosity by making him back it by bank-notes. The author was much bolder, and his penalty was, apparently, some £24,000 per lb. of steam. He entirely agreed with him on the importance of attention to detail; it had been his practice to give clear instructions as to conditions of testing new plant some time before the event.

Mr. Scanes described his vacuum efficiency and absolute pressure gauge for surface condensers, which was intended for permanent fixing in the power-house. The author was rather hard on the rotary air pump and considered the steam jet better, but the rotary could be thermally as good as the other type. Fixing the surface area of the condensers might lead to trouble; one designer would do much better than another on the same surface.

Mr. W. B. Woodhouse said there were enormous differences between the results of overall tests and individual plant tests, and these were largely to be traced to the boiler-house. The fuel burnt should be tested on a working scale. Detailed investigation was necessary, and there should be someone qualified to carry it out. Many elaborate recording and testing devices were installed in central stations and they were often far from accurate.

Mr. Holehouse referred to the performance of cooling towers, suggesting that if it were possible to fix the upper temperature and quantity of water, then the contractor could give the desired cooling. The cooling tower should be arranged to work over temperature limits corresponding to the condenser, but with the modern turbine discharge at high temperature it was difficult to give reliable figures for cooling effect.

Mr. Horace Boot said it was usual to arrange previously exactly what was to be done on a test and to give curves of vacuum correction. He had found the great value of continuous-recording instruments in stations to keep the engineer in close touch with the working of his plant; he mentioned that he had found from experience the great accuracy of the V-notch for water measurements.

Mr. Whipple referred to the value of distance thermometer installations in the central stations.

The Author, in reply, said the necessary corrections were now often made in specifications. High boiler efficiencies unaccompanied by some explanation of the methods of obtaining them were misleading.

Discussion at Birmingham.

Mr. R. A. Chattock, in opening the discussion, said it was of the utmost importance from the buyer's point of view that tests should be carried out with proper accuracy. The carrying out of such tests necessitated the employment of trained observers who were experienced in such work and whose operations were carefully organised. It was usual to rely upon the contractor to supply the men required for this work, and to place with them men representing the purchaser to check the readings. It was obviously very much more satisfactory to employ an entirely independent testing authority. In connection with large power stations this plan would prove more satisfactory because the ordinary duties of the station staff would then not be interfered with. Mr. Chattock emphasised that testing of all kinds was practically useless unless the conditions and performance guarantees were clearly set out in the specification. With regard to Mr. Selvey's suggestion that water passing through cooling towers should be measured by the thermal method, it seemed to Mr. Chattock that an error might creep into this method. He preferred to measure the water by a weir whenever possible.

Mr. Scanes explained his gauge for measuring air leakage in condensing plant. After doing so he remarked that he thought Mr. Selvey had not done credit to the rotary air pump as compared with a steam jet., and described certain advantageous features of the rotary pump

Mr. Kaula thought that condenser tests should be carried out on site, and not in the manufacturer's works. He also drew attention to the necessity for more definite information regarding air leakage, as this was very important to the designer of condensing plant. In his opinion, purchasers should not specify areas of condensing surface but leave the determination of that to the designer. It was desirable that the purchaser should simply state the performance required from the plant.

Mr. Hollis thought it advisable to test plant at a specified load factor, as this enabled results to be obtained which corresponded to normal conditions. He also thought that during a test, sound signalling should always be used in addition to light signalling.

Dr. Garrard advocated the laying-out of stations with permanent connections between the switchboard and the instrument test room, so that the engineer could always easily calibrate his instruments. For A.C. stations he thought that instrument testing apparatus should be as complete as in D.C. stations, to avoid the necessity of periodically sending the instruments to an independent authority for testing. He stated there was no special difficulty in so doing.

Mr. Walsh pointed out the necessity for testing pressure gauges *in situ* owing to the liability of water finding its way into the gauge tubes and interfering with their action. He also urged that electric tests should be on working power factor and not unity power factor. In this connection he mentioned that a known apparatus consisting of a choking coil and resistance enabled a load of proper character to be obtained conveniently.

Mr. Mills thought that when the efficiency of a boiler was stated it should also be stated whether or not the power required by accessories, such as mechanical stokers, was included in the test. The station engineer should specify the surface required in condensers, as he knew better than the designer the conditions of his station.

The Chairman, Dr. Railing, in bringing the discussion to a close, dwelt upon the advisability of incurring extra capital outlay when it was justified by increased efficiency. He urged that capital cost should not be adhered to strictly as the determining feature in the purchase of plant.

ELECTRICITY IN MINES.

In a paper read before the North of England Institute of Mining and Mechanical Engineers on October 10th, and reported in the *Colliery Guardian*, Mr. George J. Ralph described a portable electrical gas-detecting device for use with miners' lamps, depending upon the effect of a gassy atmosphere upon the resistance of an initially-heated platinum wire. The alteration in the resistance of the wire is estimated by comparing it with a similar wire sealed up in such a manner that the surrounding gassy atmosphere cannot act upon it.

In the gas detector the galvanometer is of the moving-coil pattern; a very long pointer cannot be used to indicate the very small angular movement of the coil, and if a short pointer were employed, the divisions on the scale would be so small that it would be very difficult to read them with accuracy. Instead, therefore, of attempting to read the magnitude of movement of the galvanometer pointer, the bridge circuit is so arranged that when the pointer shows a deflection it may be brought back to zero by moving a sliding contact on a wire that forms part of the circuit. It is the magnitude of the movement of this sliding contact necessary to bring the galvanometer pointer to zero that is read, and this acts, as it were, as a multiplier to the length of the pointer. In other words, if the pointer of the galvanometer is 3 in. long, and moves 1-16 in. from zero, the amount of movement of the sliding contact may be as much as ¾ in., or eight times as great, equivalent to a pointer 24 in. long.

The temperature at which the active wire gives the best result is about a dull red heat. This temperature is considerably below the ignition point of firedamp or methane. At this comparatively low temperature, the wire will last a very long time without burning out, and there will be little or no permanent change in its resistance.

Fig. 1 (p. 812) is a diagram of the arrangement of the device. A is a battery, D, E, F and G are the four arms of a Wheatstone bridge; H is a wire of low resistance compared with any of the four arms; and J is an electrical measuring instrument. The free ends of F and G are connected together to one terminal of the galvanometer J; the other terminal is connected to some part of the wire H through the contact arm K, which can be made to slide along the wire H.

Assuming that under normal conditions (that is, when no inflammable gas is present in the air) the electrical resistance of D equals E and F equals G, then the contact K must be resting on a point of the wire H exactly midway between D and E. Let it be assumed that D is the platinum wire exposed to the atmosphere, and that E is a similar wire shielded from the atmosphere, while F and G remain equal in resistance to one another under all conditions. If, owing to the presence of some hydrocarbon gas, the resistance of D increases, a current will pass through the galvanometer, causing the pointer to show a deflection. By sliding the contact arm K away from the central position towards D, a position can be found which will restore the balance and allow no current to pass through the galvanometer, which consequently returns to the zero position. The new position of the arm K is then noted. The positions which K must occupy in order to bring the galvanometer needle to zero are carefully marked when D is surrounded by air containing various measured percentages of gas.

The present form of the device is adapted either for use with a small separate battery of its own, or for use in conjunction with an electric lamp, whichever may eventually prove the more convenient.

There is every indication that the device will meet technical requirements, and that it can be produced at such a price as will render it commercially practicable for adoption by mining officials, deputies, and firemen. Its weight is about 1 lb. without a battery. There is no risk attending its use.

Actual trials have been carried out in a mine, and also with natural pit gas, as well as with artificially prepared methane, all the results of which agree.

Mr. Robert Nelson, H.M. Electrical Inspector of Mines, wrote stating that the principle upon which the detector was constructed seemed to him to be both scientific and practical. The most convenient form, if the detector proved to be a practical success—and he knew no reason why it should not—would, he thought, be that in which the detector was furnished with its own battery apart from any lamp.

Mr. Wm. Ollerenshaw, of Denton, wrote that the apparatus appeared to meet all the requirements necessary to make a portable electric safety lamp for miners an unqualified success and, if that object were achieved, it would do more, in his opinion, to lessen the loss of life in coal mining than any other invention of the present century. The increased light

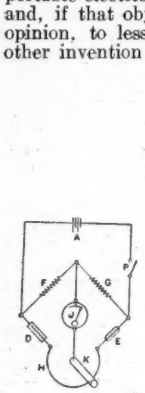
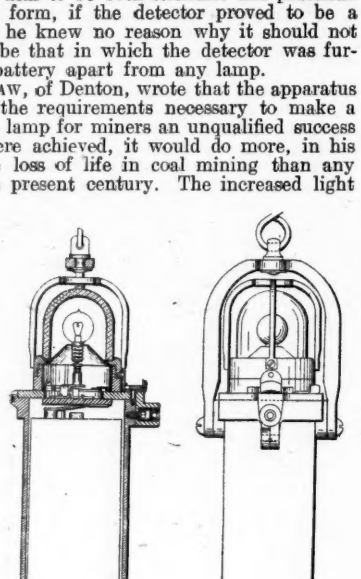


Fig. 1.—Ralph Gas-Detector.



Figs. 2 and 3.—Section and Elevation of Bristol Safety Lamp, Type B.T.

of the electric lamp would enable the underground workman to detect the danger and prevent the occurrence of many of the accidents which now accompanied the industry.

Prof. P. P. Bedson said that it seemed to him that Mr. Ralph had taken a distinct step forward. He had given them a means of fixing the percentage of firedamp, without the personal equation entering into it.

Prof. Henry Louis said that at a low red heat coaldust ignited readily. If that detector were introduced into a very dusty mine, fine coaldust might find its way in, and they might have all the elements that would cause an explosion.

Mr. J. H. Merivale (the Secretary) said that he had noticed that the lamp was provided with a gauze, so that in the event of any ignition inside the lamp that ignition would

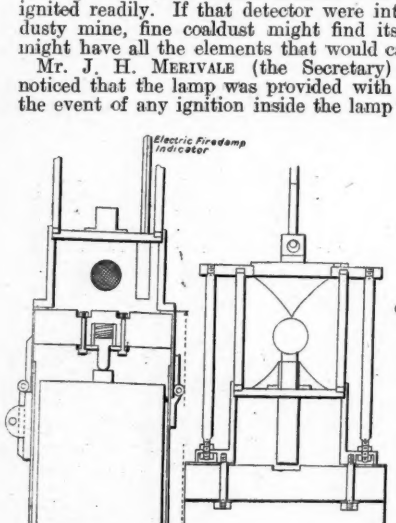


Fig. 4.—Manley & Sandy Lamp with Gas Detector.

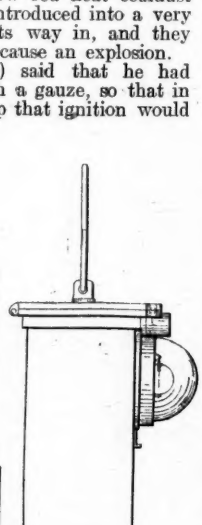


Fig. 5.—Bristol Lamp, Type B.R.

be confined to the interior. There was no danger of the platinum wire getting beyond red heat, the voltage of the battery not admitting of it.

Mr. Wilson, H.M. Inspector of Mines, said that from what had been said, he should imagine that the instrument was absolutely safeguarded.

The President proposed a vote of thanks to Mr. Ralph, and said that, assuming that the instrument was as reliable and perfect as Mr. Ralph said it was, it was a more accurate means of detecting quantities of gas in the air current than the ordinary safety lamp, into the use of which the personal equation entered, and rendered it so liable to mistakes and errors, which might have serious consequences.

Replying, Mr. Ralph remarked that Prof. Louis had mentioned the possible danger from coal dust. In the mine into which he went in South Wales, an exceedingly dusty mine, no trouble was experienced. He thought the gauze was a fairly good protection, and red-hot wire was certainly very much safer than a flame enclosed by gauze. Working platinum at that comparatively low temperature, the alteration in resistance, if any, was very minute and one might expect the heaters to last for a very long time.

In a paper read before the Midland Institute of Mining, Civil and Mechanical Engineers, also published in the *Colliery Guardian*, the case for the electric lamp was supported by Mr. William Maurice. He stated that a considerable extension in the use of electric lamps had lately taken place, and it was known that inspectors of mines favoured development in this direction.

In his opinion there was no known invention which was likely to have so beneficial an influence on labour conditions, which was so clearly destined to improve the miner's lot, or gave such bright promise of reducing the risks of underground work to anything like the same extent, as the portable electric lamp. The oil lamp had had its day. The illumination which it provided was not very notably better now than that which was obtainable thirty years ago.

Light was what a lamp was provided for. Any other property that a flame safety lamp might possess should be recognised as subsidiary to its main purpose. In the mine "more light" seemed to him to offer the easiest possible solution of many problems that had hitherto been regarded as either technically or commercially insoluble. More light in the mine meant:—

1. Cleaner coal.
2. Increased output per man, whether engaged in stall- or road-work.
3. Less time lost in starting work.
4. Less time lost in re-lighting lamps.
5. More effective supervision.
6. Enormously diminished risk of firedamp explosions and underground fires.
7. Fewer accidents from falls of roof and side.
8. Fewer haulage accidents.
9. Fewer miscellaneous accidents.
10. Reduction in the number of cases and probably a complete elimination of miners' nystagmus.
11. Reduced cost of insurance and compensation for injuries.
12. More agreeable conditions of labour.

That there would be less excuse for filling stone and dirt with coal when the light was good must be self-evident, and it was already known to mine managers that some improvement had actually been obtained. It had also been recognised that miners could and did fill more coal, and do more yardage on straight work, when using electric lamps. They had moreover, been the first to admit that they had done more work with no perceptible extra effort.

In a pit employing 1,000 men, in the course of a five-shift working week the value of a loss of one minute per man per shift was £3 15s., which was probably sufficient to pay for the extra cost of maintenance of electric lamps.

There was quite a serious loss of time in sending workmen to lamp stations to get their lamps re-lighted when these had from one cause or another gone out. If 10 per cent. of the flame safety lamps used underground got "in the dark" each shift—and he believed the official statistics recorded a higher percentage than this—the number of hours of working time lost per day must be considerable. "Time was money" both to the coal owner and to the miner. Every stallman who lost a minute lost a farthing!

That more effective supervision was possible with better light hardly needed argument.

With regard to the contention that the substitution of electric for flame safety lamps would diminish the risk of firedamp explosions, his personal opinion was based upon more than 24 years' experience of miners' lamps, both flame safety and electric, some 15 years of which were devoted to active colliery management. There was ample genuine legal evidence that flame safety lamps might be a source of danger in the mine. Nothing could alter the fact that a "safety lamp" was only a more or less carefully shielded naked flame. Workmen had been known to boast that there was no safety lamp which they could not open if they were so minded, and in any case a broken glass, a blow from a pick, or even the omission of a washer, might convert a flame lamp into a direct source of danger. Above all, there was the fact that the light given by even the best safety lamp was quite inadequate as a means of protection from dangers other than gas. Falls of roof had taken a greater toll of lives than explosions; and therefore the greatest contributory agent to general safety was "more light."

That more effective lighting would diminish the incidence of nystagmus was now beyond question. It was, however, necessary to say that those who installed electric lamps for the special purpose of eliminating nystagmus and looked for immediate results were likely to be disappointed. The rate of improvement would depend upon the nature and long standing of the cases, and on the proportion of latent tendencies in individual cases among those employed in the mine. A really reliable opinion on the effect of improved lighting conditions on nystagmus could not be expected in less than three years. In this connection discrimination should be exercised between the photometric value of light and its useful effect in the places where it was to be employed. The photometric value of a given light was not necessarily an indication of its practical usefulness. The condition

of the electrodes in a cell, the particular point in the life of the cell at which the test was made, the density of the electrolyte, the rate of charge, the condition (as to cleanliness, etc.) of the contacts, the make and quality of the metallic filament lamp bulb, the number of hours that it had previously "burned," the quality and condition of the outer glass, and many other points, had all an important bearing on the photometric value of an electric lamp and the duration of its light. Only an average of many tests taken throughout the working life of a lamp would give reliable data. Many electric lamp installations were both costing more to maintain and giving much less satisfactory service than they would if they were cared for in a reasonably intelligent fashion.

A great deal more lay in the proper management of electric lamp cabins than appeared to be generally supposed. It was commonly said not many years ago that a coal owner would expend many thousands of pounds on electric plant, and then put a wooden-legged labourer in charge of it. The criticism was essentially true. Many thousands of pounds had been spent by coal owners on repairs and renewals to electric plant which would never have been required if competent men had been placed in charge. It had taken an Act of Parliament to effect a change that ought to have been dictated by common sense. Thousands of pounds were now being spent in providing electric lamps, and was it not a fact that the lamp room had been generally manned by the maimed and decrepit soldiers of the mining army? A well-organised electric lamp cabin was in itself still somewhat of a novelty. The successful management of one called for a higher degree of intelligence than had hitherto been considered necessary. The provision of that higher degree of intelligence made all the difference between success and failure; the omission of it was misplaced and most costly economy.

The elimination of nystagmus, the reduction of other insurance and compensation charges, the improved quality and quantity of output, the increased efficiency of the workers, and, not least, the greater comfort with which men worked when using electric lamps, must all tell in favour of this undoubted underground revolution—a revolution which was destined to affect radically the practice of mining, which would promote safety and efficiency in directions that were here only remotely indicated, and which would be so beneficent alike to owners and to mine workers that the mining engineers of the future would marvel if it should appear that, like the British Empire, "it came about during a fit of absence of mind."

The Home Office has issued a list of types of safety lamps that are approved for use in coal mines, entitled "The Safety Lamps Order of the 7th October, 1914." The electric lamps now approved for general use are the following:—

Bristol Safety Lamp, type B.T. 4V.—Metal case, unspillable accumulator, hinged cover, lamp and reflector under glass dome, flame-tight switch, and lead-rivet lock. Total weight, not more than 4¾ lb. Light not less than 1 c.p. in horizontal plane all round for nine hours, and not less than 1.5 c.p. over an arc of 45°. The lamp is illustrated in figs. 2 and 3, p. 812.

Manley & Sandy Lamp with electric gas indicator.—Sheet-steel case, unspillable accumulator, hinged steel cover, lead-rivet lock, cylinder on cover containing gas-testing device (the efficiency of which has not been tested by the Home Office), lamp and reflectors in glass cylinder, flame-tight switches for lamp and indicator. Total weight not more than 8 lb., candle-power as above (fig. 4).

Other lamps which have been previously approved are the B.A.C., Ceag, Turquand-Kingsway, Gray-Sussmann Nos. 3 and 4, Joel-Fors Type 403 M, Oldham, Thomson-Rothwell, Varta, and Wolf (Alkaline, Lead, and No. 2).

Approval has also been given for use by officials to the Bristol Safety Lamp, Type B.R., 4V. This is of the bull's-eye type, a modification of the B.T. type, weighing not more than 4¼ lbs., and giving 1.5 c.p. for nine hours (fig. 5).

Other lamps approved for use by officials or for special purposes are the Float, Joel-Fors, Types 303C and 403H, Oldham Emergency and Types A and B, Varta, Type 2 Et. 4, and Wolf Rescue No. 2.

WAR ITEMS.

Japan as an Electrical Manufacturer.—The "Japan Weekly Chronicle" has the following:—"Hitherto most of the dynamos and other electrical machinery in Japan have been supplied by the General Electric, Westinghouse and Siemens Schuckert Companies, American, English and German especially. The Tone Electric Company, however, is said to be making a notable departure, having ordered the construction of these dynamos of 6,000 kw. each in Japan. These machines are to be made by the Hitachi Works, and the iron pipes for the same power installation are to be supplied by the Shibaura Works. It is believed that these orders are the precursors of a large industry in Japan. It is certainly a good time to make the attempt, when the European trade is so badly interrupted, and there is a large supply of cheap copper in Japan."

German Trade with Canada.—In a special report on German trade with Canada, which has been prepared by H.M. Trade Commissioner for the Dominion (Mr. C. Hamilton Wickes), it is stated that Germany's efforts to expand her trade in the Dominion have been characterised by the same thoroughness and efficiency which have distinguished her trade campaigns in other countries. The value of German trade with Canada is small, however, as compared with that of the United States and the United Kingdom, the value of the German goods imported during the fiscal year ended 31st March, 1913 having amounted to only about £2,900,000 as compared with £28,500,000 from the United Kingdom and £90,600,000 from the United States. The most important branch of Germany's trade with Canada, apart from specialities (such as certain lines of chemicals, tyres for locomotives, and scientific instruments), consists of low-priced imitations or reproductions of British manufactures; the effect of these is seriously to reduce the value of the retailers' stock of the British-made article. It is the poorer classes which purchase these goods, being in many cases ignorant of quality and value, and their small means drive them to buy a low-priced article in the hope that it is really cheap from an economic standpoint. British manufactures, which are usually of higher price than the German goods, but of intrinsically greater value, require to be given greater publicity, as well as assistance by first-class selling methods, to enable them to compete with low-priced goods; it is well-known, however, that this side of the trade is neglected, and in many cases the British manufacturer handicaps himself further by indifferent knowledge of the local market conditions, ignorance of these conditions being a serious feature preventing him from obtaining a due share of the trade to which the excellence of his manufactures entitles him. Copies of the report, which also contains detailed statistics of Germany's trade with Canada during the years 1908-9, 1912-13, and 1913-14, may be obtained by United Kingdom manufacturers on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Trade Openings in Belgium.—The Belgian Chamber of Commerce in London (Incorporated), of 24, St. Dunstan's Buildings, St. Dunstan's Hill, E.C., writes to us as follows:—"Through the columns of your valuable paper may we draw the attention of English manufacturers to the splendid opportunity they have at present for making arrangements to be represented in Belgium. Amongst the good class of refugees there are a number who, before the war, acted for German firms, and who are wishful to replace these makers by English manufacturers of similar goods. These refugees are here unoccupied and would be very pleased to spend their time in acquiring the knowledge of the lines they will be called upon to introduce later on. The Belgium Chamber of Commerce in London is at the disposal of manufacturers to put them in communication with suitable applicants for such posts. We further take advantage of the present to invite all employers who have vacancies for foreign correspondents, etc., to let us have particulars of their requirements, as the enforced idleness is very irksome to our countrymen." The letter is signed by L. Godchaux, president, and P. Dorchy, the general secretary.

The Skilled Labour Problem.—The "Times" states that an important private conference, arranged between the Engineering Employers' Federation and representatives of the Amalgamated Society of Engineers and kindred societies, began at Sheffield on the 10th inst., to discuss in what way the skilled engineering labour now available, which is considerably less than in normal times owing to enlistments, can be best organised so as to hasten the increased work throughout the country. The conference discussed at length the question of a revision of some of the more stringent rules of the Amalgamated Society of Engineers with a view to allowing the temporary introduction of less skilled labour—that of labourers and women—in certain departments.

Salford Tramwaymen and the War.—Following the example of Manchester, notices have now been posted in the Salford cars indicating what the Salford tramways department has done in connection with the war. No fewer than 338 employés of the department, or 26 per cent., have joined the forces, and several have already been killed and a large number wounded. The amount paid by the Corporation per week to dependents of tramway employés on active service is £800; the amount contributed by the employés out of their wages for various relief funds is £300, and passengers travelling on the cars have contributed £532 for relief purposes.

America's Trade Campaign.—The United States Department of Commerce announces the following appointments: Mr. H. D. Baker as commercial attaché at Petrograd, transferred from Bombay; Mr. V. L. Havens, as commercial attaché at Santiago, after having acted as consulting engineer on railway, electric and irrigation schemes throughout South America; five commercial agents to study respectively trade openings for hardware, electrical machinery, furniture, and general machinery, including machine tools, in South America.

Xmas Gifts.—Liverpool Corporation Tramways Committee is providing a Xmas gift for each of its 700 former employés now serving with the colours.

Accrington Tram Shed.—The new tram shed at Accrington, which is nearly completed, is to be placed at the disposal of the Accrington "Pals" Battalion for drill purposes.

D

Bath Electric Supply Men with the Colours.—The following is a list of the men from the Bath Corporation Electricity Department who have been or are now serving with the colours:—

Lambern, E.	Royal Artillery.
Carpenter, A.	Royal Artillery.
Kirkham, C. E.	Royal Artillery.
Wyatt, J.	Royal Engineers.
Brooks, F.	Royal Engineers.
Seal, T.	Duke of Cornwall's L.I. (killed in action).
Howell, J. C.	10th Devons.
Scane, H. G.	1st Batt. Somerset L.I. (killed in action).
Dixon, T. R.	1st Batt. Somerset L.I. (missing).
Mead, F.	1st Batt. Somerset L.I. (prisoner of war).
Lee, J. A.	1st Batt. Somerset L.I.
Holley, E.	6th Batt. Somerset L.I.
Froud, J.	7th Batt. Somerset L.I.
Parfitt, G.	4th Batt. Somerset L.I.
Jones, Knox.	4th Batt. Somerset L.I.
Sydenham, H. G.	4th Batt. Somerset L.I.
Woods, G.	R.A.M.C.
Howard, J.	5th Dragoon Guards.

Australia and the Metal Trades.—A Central News dispatch, quoted in the "Westminster Gazette," says that, "speaking in Parliament, Mr. Hughes said that German capital and influences monopolised the world's base metal industry. The war would be waged in vain if, when victory was won, Australia was compelled to pour into Germany's lap the wealth created by Australian enterprise. The Federal Government had communicated with the British Government requesting co-operation in protecting British and Australian interests, so that we might no longer build up the power and influence of the nation sworn to humiliate us."

Trade with Australia.—We have received from the Office of the Commonwealth of Australia, 72, Victoria Street, London, S.W., a pamphlet dealing with Australia's trade with Germany, which is issued for the purpose of assisting those who are trying to increase their trade with the Colonies. Statistical information is included showing German imports into Australia and Australia's exports to Germany in useful detail over a number of years. Many pages are occupied with names and addresses of exporters of Australia's principal products, and of the principal Australian exporters represented in Great Britain.

Germany and Copper.—A Reuter dispatch from Amsterdam says that the Germans concerned by the scarcity of copper are confiscating copper kettles and utensils at villages, etc., on the Belgo-German frontier. The price of copper in Germany is stated to be £150 to £160 per ton. It is said that gas and electric light fittings, shopfronts, staircases, etc., in Germany are being requisitioned for the copper that they contain so that the voracious Krupp appetite may be satisfied.

Northampton Tramway Manager.—Mr. John G. Cameron, whose appointment to the management of the Northampton tramways was alluded to on page 784 of our last issue, has been with the Northampton Corporation for 10½ years, during 6½ of which he has held the office of borough electrical and tramway engineer. We regret the error which appeared in our last issue.

Free Rides Cancelled.—In consequence of certain cars being crowded with soldiers, to the detriment of the ordinary passengers who had to walk to their destination, the Blackburn tramway authorities have cancelled all free-ride concessions to men in uniform, whether soldiers, policemen, or boy scouts.

Constantinople Telephones.—Owing to the war with Turkey the half-year's interest due 1st January on the six per cent. Obligation bonds of the Constantinople Telephone Company must be postponed. Advices from Constantinople state that the service is still being maintained under the direction of the British staff.—"Financial Times."

Mining Dispute.—The "Standard" states that last week the Hetton Colliery, in the Newcastle district of New South Wales, was rendered idle owing to the miners' refusal to work with a naturalised German employed on the mine as an electrician. The man was alleged to be anti-British.

Personal.—Private W. Shaw, a Blackburn tramway employé, in a letter to the manager of the tramways (Mr. J. H. Cowell), states that he took part in 13 bayonet charges before he was wounded. He is now in the culinary department serving General French's staff.

At Rochdale, amongst a number of Belgian refugees who are being taught to weave, is one who was formerly an electrician.

Private E. Brown, 1st East Yorks Regiment, who has been wounded in action, was, prior to the war, employed in the Rochdale electricity works.

Mr. George Wilkinson, borough electrical engineer of Harrogate, has received some interesting letters from his son, Lieut. Wilkinson, of the 2nd Battalion Lancashire Fusiliers, who was wounded at Cambrai, and is now a prisoner in the hands of the Germans. Lieut. Wilkinson has related many experiences, and told how he was wounded and picked up by the Germans, who put him in hospital and treated him well.

Mr. S. Hann, electrical engineer with the Stoke Newington B.C., has joined the Royal Naval Division, Public Schools Section.

Royal Naval Public School Battalion.—A Public School Battalion of 1,000 men is being raised for service with the Royal Naval Division, age 18 to 35. It will be strictly limited to public school and university men. Applicants desiring to enrol should apply at once to Royal Naval Division, 6, 7 & 8, Old Bond Street, London, W. Phone: Regent 5515.

Roll of Honour.—Mr. Thomas Brennan, formerly employed at the British Westinghouse Works, Trafford Park, who has been serving with the Grenadier Guards at the front, has been killed in action.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Weather-Proof Lanterns.

Fittings manufacturers in this country are recovering from the inconvenience caused by the stoppage of supplies of vitreous enamelled material, a large percentage of which was obtained from Continental sources; so far as outside fittings are concerned, where waterproofing is absolutely essential, huge quantities of fittings were purchased from abroad. In many cases zinc or polished copper is being introduced in the place of enamelled iron, and Messrs. Siemens Bros. Dynamo Works, Ltd., of Tyssen Street, Dalston, have developed certain types of copper and zinc lanterns, which they can supply from stock. They are also in a position to supply an entirely British-made lantern for half-watt lamps in vitreous enamelled iron. The design of this lantern embodies many of the advantages claimed for the Continental type, and the cost is about the same. We illustrate here a sectional view, together with a reproduction of an actual photograph.

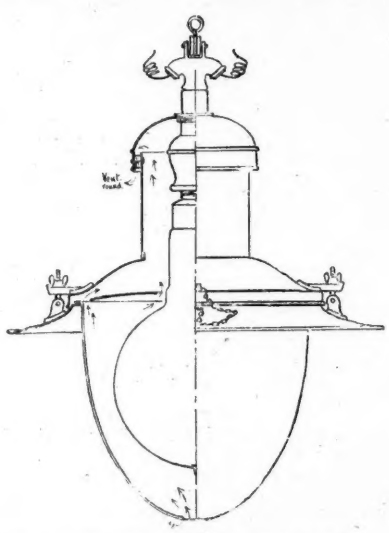


Fig. 1.—Section of Half-Watt Lantern.

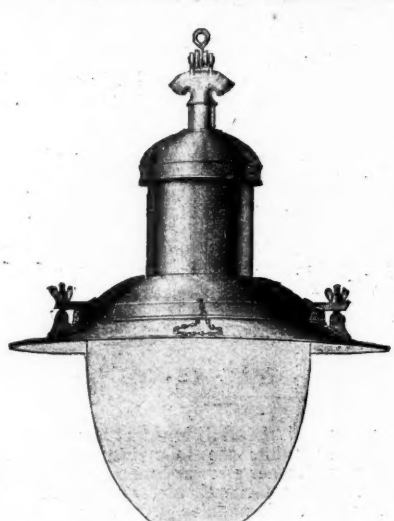


Fig. 2.—British-Made Lantern in Vitreous-Enamelled Iron.

"Sirocco" Air Washer.

Messrs. Davidson & Co., Ltd., of Sirocco Engineering Works, Belfast, have just placed on the market an air washer, which we illustrate herewith. It consists of a galvanised iron tank kept filled with water by a ball cock, a sump at the end of the tank containing primary and secondary filters, and the washer proper mounted on the tank. The casing is open at both ends, and can be connected to an inlet and fan suction by suitable tapered connections; a glazed inspection door is provided, and the valves and pressure gauges are fixed on one side with all the water connections. The spray chamber is fitted with a number of atomising nozzles which fill the chamber with a thick mist of fine particles of water, with which the air is thoroughly mixed; on leaving the chamber the wet air impinges on a series of corrugated baffle plates, which are constantly flooded with water from a row of spray nozzles fixed over them, so that foreign matter deposited on the plates is washed down to the settling tank. The purified air then passes through triple eliminator plates of galvanised sheet-steel, set at an angle to the air current, so that the air is deflected from side to side, and caused to deposit suspended moisture, without, however, setting up any material resistance to its flow. The air leaves the washer with an average humidity of 90 per cent.

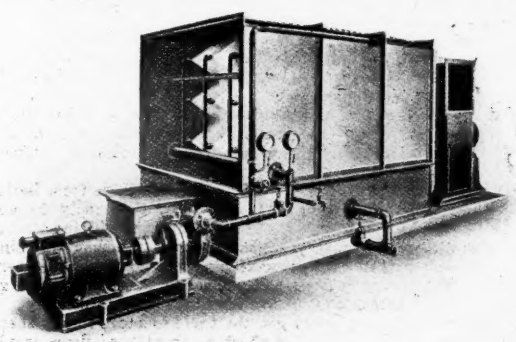


Fig. 3.—Sirocco Washer and Circulating Pump.

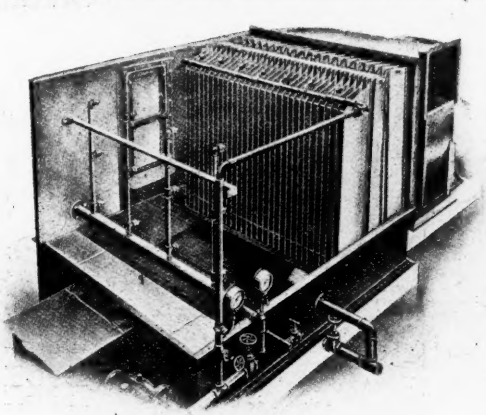


Fig. 4.—Interior of Washer, Showing Nozzles, Scrubber and Eliminator Plates.

The water used by the sprays is constantly recirculated by a small centrifugal pump, drawing from the filter sump; a washer rated at 20,000 cb. ft. of air per minute is provided with a pump absorbing 4½ H.P. The Sirocco washer is made in 15 sizes, and is eminently suitable for use with electric generators.

Ferranti Electric Cookers.

Messrs. Ferranti, Ltd., of Central House, Kingsway, W.C., have issued a new list of electric cooking appliances, amongst which is a series of ovens taking from 1,350 to 3,300 watts on the full heat, and reaching a temperature of 350° F. in 20-25 minutes. These ovens are fitted with the Ferranti element, which is illustrated in fig. 5. It consists of a heating spiral mounted on porcelain bars, clamped together. Each complete element consists of two or three such units fixed in an iron frame and protected by perforated sheet metal, a frame being fitted into each side of the oven behind the shelf racks. The frames have connections for three heats and earth, and are provided with plugs which fit into sockets mounted in porcelain at the bottom of the oven. Thus a frame can easily be removed and replaced. The ovens are of black enamelled cast-iron, lined with enamelled steel sheet, and packed with non-conducting lagging. Fig. 6 shows a complete cooker with ironclad switchboard, the top plate being equipped with two 2-heat boiling plates and a grill. The latter is also supplied separately, as shown in fig. 7, in which a similar heating element is used, under the top plate. The grill pan can be raised or lowered to adjust the intensity of the heat, and a guard under the heating element prevents accidental contact with the latter.

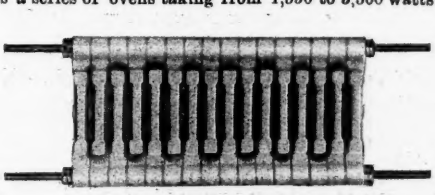


Fig. 5.—Ferranti Oven Element.

Fig. 6.—Complete Ferranti Cooker.

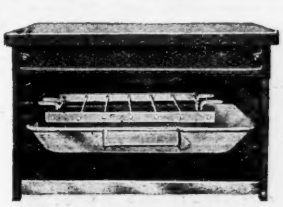


Fig. 7.—Electric Grill.

Benjamin Half-Watt Fittings.

A new line of "half-watt" lanterns and reflectors has been marketed by the Benjamin Electric, Ltd., of 1A, Rosebery Avenue, London, E.C. Fig. 8 is a black-enamelled steel or polished copper head with a 20-in. enamelled reflector and translucent globe;

Figs. 8 and 9.—Benjamin Half-watt Fittings.

the lampholder is of the Benjamin Goliath pattern, and the fitting is suitable for use with lamps of 500 and 1,000 watts. Fig. 9 shows a lantern head without a globe, completely enclosing the lamp, and giving a widely distributed illumination. The head is well ventilated, and embodies the latest improvements.

Ediswan Traction Lamp.

The Edison & Swan U.E.L. Co., Ltd., of Ponder's End, London, have introduced a special traction lamp with drawn-wire tungsten filament, which we illustrate in fig. 10. The filament is supported in short lengths, to give the necessary rigidity, and is mounted in a pear-shaped bulb; the lamp is rated at 100 volts, 30 watts, and is suitable for all standard fittings on tramcars and electric trains,

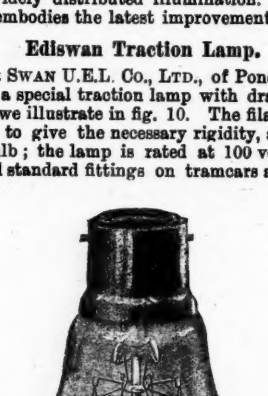


Fig. 10.—"Royal Ediswan" Traction Wire Lamp.

as well as for use in mills and other places where vibration and rough handling are inevitable. A smaller lamp is made for train lighting from batteries, and other types are supplied for automobile lighting.

The Ediswan lamps are made throughout, from the glass bulb to the lamp collar, at the Ponder's End Works of the company.

Triangle Toaster Stove.

The Western Electric Co., Ltd., of Woolwich, E., have introduced an extremely moderate priced electric stove known as the Triangle, 6 in. in diameter, 1¼ lb. in weight. The heating coils, arranged horizontally in a circular frame, are supported above the base, and toast can be made both above or below them, or the upper surface used for boiling and cooking, while the underside is reserved for toasting. This device is in sheet steel, nickel polished, and stands on fibre insulating legs. We gather that the heating elements are guaranteed "for ever."

CORRESPONDENCE.

Letters received by us after 5 P.M. on Tuesday cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

German Agencies.

With respect to certain German firms trading in this country, it would be interesting to know whether the Electrical Co., Ltd., are still carrying on business, as I should have thought they would have been the first to close down altogether. Instead of this, I understand they are now posing as factors of English-made goods, and, consequently, any profits that are obtained by this means are being hoarded up for the purpose of assisting our enemies at the end of the war.

I note they are extremely careful never to enter into any correspondence in the papers, or to make the slightest answer to anything that is said concerning them. I expect they imagine by doing this that they will probably be overlooked, and it will be an easy matter to convince private buyers that they are a purely British firm.

The definition of an English firm is rather a curious one, as it seems to me to be perfectly easy for any firm, where the whole of the capital is held in Germany, but the company is registered in England, to call themselves a British firm, and, at the same time, to be speaking the truth.

In the case of the Electrical Co., Ltd., it may be taken that the whole of the capital is held by the Allgemeine Elektrizitäts Gesellschaft, of Berlin, as the balance of shares not held by them are held by Germans; such balance of shares only amounts to 40, so, strictly speaking, the Electrical Co., Ltd., entirely belongs to the A.E.G. Co.

It is only a week or so ago that the managing director of this concern made certain remarks respecting the English nation, and these remarks were in no way different from the usual mad-dog style of speaking which the Germans use towards the British.

It would appear that the British public hold such extraordinary views that they would in the case of firms with such obviously German names as Siemens be inclined to grind them out of existence altogether, entirely irrespective of the enormous benefits which Messrs. Siemens's works confer on this country, in view of the fact that all things manufactured in their works must be made under similar conditions to our own manufactures; but, in the case of the Electrical Co., this, of course, has no German sound about it—and the wonder to me is that they did not call themselves the "British Electrical Co.," so that the general public would think everything was quite satisfactory.

They are now shrewd enough to make themselves out to be factors of English goods, and it would be interesting to know how much English goods they factored before the war, and especially in proportion to the amount of German manufactured goods, as it is well known that they have no works in this country, and are quite different from many other firms which can be mentioned, who have, but are firms which have a large proportion of German capital in them.

The Electrical Co. have possibly received instructions from Berlin that under no circumstances whatever must they reply to any remarks made about them, so that naturally, there being no discussion on the matter, no one seems to bother, and they are going on in the old way, and I suppose keeping the place together very nicely until the war is over and the accumulated profits can go towards paying the losses that have been incurred in Germany.

It seems entirely hopeless to get the trade to move in any shape or form to make some concerted effort so that these firms would have to shut up altogether, but surely it should be the duty of someone to see that trading by people of this kind is made impossible, and they should not be allowed to shelter themselves behind the fact that they employ a few Englishmen; nor are we in any way taken in by the fact that about half-a-dozen Englishmen employed in their works in Berlin wrote during the early part of the war, and said how well they were treated. It would be interesting to know whether such nice treatment has been carried on up to the present time.

There are other electrical companies who require to be put into the same position, but I do not quite see how it is possible to eliminate them all at once; but it would be a step in the right direction if we could start with a firm as large as this.

Contractor.

December 11th, 1914.

American Activity in the Australian Market.

The following letters, &c., have been received by us; this is significant:—

From	Great Britain. Letters.	Great Britain. Price lists.	U.S.A. Letters.	U.S.A. Price lists.	Continent. Letters.	Continent. Price lists.
July	64	18	1	22	22	13
	40	4	5	10	27	4
	58	6	2	4	13	7
	33	2	1	16	18	14
August	76	7	17	4	11	9
	57	9	21	4	24	2
	41	16	24	12	17	0
	63	3	16	9	—	0
September	27	0	82	41	1	—
	9	1	96	89	—	—
	—	2	108	121	—	—
	5	—	70	45	—	—
October	7	2	61	66	—	—
	11	—	107	81	—	—
	—	—	71	82	—	—
	9	1	63	57	—	—

U. Soon. Approached.

Sydney, *November 3rd, 1914.*

A Stereopyrometer Wanted.

Will you kindly allow me to ask the readers of your paper if any of them can tell me where to get a temperature indicator known as a stereopyrometer?

W. Hibbert,
Polytechnic, Regent Street, London.

December 11th, 1914.

Electric Vehicle Manufacture at Ipswich.—Messrs. Mossay & Co., Ltd., announce that they have concluded arrangements with Messrs. Ransomes, Sims & Jefferies, Ltd., Orwell Works, Ipswich, for the manufacture of electric vehicles to their design. These vehicles will be of the front-wheel drive type, with two separate motors and underslung battery. The chassis will be made in various sizes as lorries and vans of 1, 1½ and 2½ tons carrying capacity, and will be suitable for dust-vans, tipping-wagons, tower-wagons, &c. They will be known as "Orwell" chassis, and the selling agency for these vehicles for the United Kingdom will be placed in the hands of Messrs. Mossay & Co., Ltd., 45, Horseferry Road, Westminster, London, S.W.

LEGAL.

The South London Electric Supply Corporation, Ltd.

Undue Preference.

On Friday last, Mr. Justice Eve, in the Chancery Division, had before him a motion: "The Attorney-General, at the relation of the South Metropolitan Gas Co., *v.* The South London Electric Supply Corporation," in which the plaintiff company applied for judgment in an action against the defendants in consequence of admissions in the defence.

Mr. Mark Romer, K.C., Mr. Maugham, and Mr. Percy Wheeler appeared for the plaintiffs, while Mr. Tyldesley Jones represented the defendants.

Mr. Romer said he moved before his Lordship, under the provisions of Order 32, Rule 6, for judgment in an action between the parties in consequence of certain admissions made in the defence by the defendants. The action was brought for the purpose of restraining the defendant company from committing a breach of Secs. 19 and 20 of the Electric Lighting Act, 1882, which prohibited electric supply companies from granting undue preference to one customer over another. A similar case was recently before Mr. Justice Sargant, and had been before the Court of Appeal. The point in the action was this. The Electric Supply Co. issued a circular in which they proposed to their customers that they would grant a rebate of ½d. per unit for electric current supplied on the condition that the customer used the company's electricity, and that only, as an illuminant. In an area in which a gas company was a rival, the object of such a circular was apparent, and the case was very similar to the one in which Mr. Justice Sargant and the Court of Appeal held that the circular was an offer of undue preference and a breach of the Electric Lighting Act. The present action was started before Mr. Justice Sargant gave his judgment, and, since the statement of claim in this action was delivered, and before the defence was delivered, the Court of Appeal decided the other case. Then the present defendants gave notice that they would not defend the plaintiffs' claim.

His Lordship: This offer was to a particular class of customers really to keep them from using gas?

Mr. Romer: Yes. In paragraph 5 of the statement of claim we set out the circular issued by the defendants.

Mr. Tyldesley Jones said his clients did not attempt to justify the circular and the offer it contained in view of the recent decision of the Court of Appeal. He would, therefore, consent to judgment in the action, and the only question was the form of the declaration, and whether the plaintiffs were entitled to an injunction. This was a trade rivalry.

His Lordship: Yes; and you are in the wrong.

Mr. Jones: That is so, and since the Court of Appeal has decided the matter, we do not question it.

Mr. Romer then read the offending circular, which was issued on March 14th last, and was to the effect that in consequence of the continued high price of coal the price of electricity would be raised from 4½d. to 5½d. per unit, and it was intended to offer a rebate of ½d. per unit to persons occupying private houses provided they used defendants' supply, and that supply only, as an illuminant. Defendants ultimately carried out that promise to their customers, and made the rebate right down to December 1st, 1914, when it was discontinued. Defendants, in reply to the statement of claim, admitted that after the issue of the circular they allowed the rebate down to December 1st, and they admitted that in doing that they had committed a breach of Secs. 19 and 20 of the Electricity Act of 1882, and were willing to submit to a declaration to that effect. Therefore, he asked for judgment. The defence, added counsel, was singularly silent as to what the defendants would do in the future, and he suggested that the plaintiffs should be granted a declaration as in the notice of motion, viz., "That the defendants were acting in breach of Secs. 19 and 20 of the Electric Lighting Act of 1882 in allowing a rebate to persons taking a supply of electricity from the defendants on condition that only the defendants' supply be used as illuminant." That embodied in the declaration the point which it was intended to raise in the action, the question whether the defendant Electric Lighting Co. could supply current to customers at lower rates on condition that those customers used only the company's electricity for lighting purposes. He (counsel) proposed to leave the mention of the ½d. rebate out of the declaration, for such a rebate was illegal, whether it was a farthing, half-penny or three-farthings.

Mr. Tyldesley Jones said he objected to the form of declaration. In all questions of undue preference it was permissible for the Electric Light Co. and similar undertakings to differentiate between two consumers when the circumstances surrounding each was different. In the case which was before Mr. Justice Sargant and the Court of Appeal, the parties had to stand or fall by the circular, and his clients were willing to do the same. They admitted that they could not justify the circular, and were prepared to fall by it, but they objected to a declaration which went further than it should. There might be cases in which the defendants might like to differentiate. For instance, supposing a man lit his living rooms with electricity and his bedrooms with gas, and the electric light company said to him: "You change your gas for electric light and I will give you better rates." That would be good ground for a legal preference, for the demand for light in the bedrooms would be at a different time to that for the living rooms. He suggested that the declaration should read: "That in making the differentiation referred to in the circular, dated September 25th, 1911, the defendants have committed a breach of the Act."

His Lordship: You say that the differentiation made in that circular is the breach of the Act?

Mr. Jones: Yes, that is the only point in the action. The general form of the declaration the plaintiffs ask for might include, say, many cases quite outside that in the circular, and I am not going to assent to anything which might hereafter be used to bind me in other matters I might have in contemplation, although they might not be in contemplation now, and to which I have had no opportunity of addressing my mind. Mr. Jones later said he would agree to the notice of motion as drafted with two alterations, and Mr. Romer said these alterations would be made.

His Lordship said he would grant the declaration asked for, but he was not disposed to grant the injunction against the defendants, seeing that they had admitted their faults, and declaration would be sufficient. There would be judgment in the action for the plaintiffs with costs.

Workmen's Compensation.—Shock Claim.

On December 8th, application was made to his Honour Sir W. Lucius Selfe, in the Marylebone County Court, for an award in favour of John Robert Lupton, platelayer, 2, Essex Road, Willesden, the respondents being the Metropolitan Railway Co.

Mr. C. Doughty, barrister, who appeared for the National Union of Railway Servants, explaining the facts, said that applicant was one of a gang which, on February 10th, was working on the line between West Hampstead and Finchley Road, when the foreman warned them to "clear off the line," as two trains were approaching from opposite directions. In doing so he stepped onto the "live" rail and the electricity threw him down. The foreman seeing him falling caught him to drag him out of the danger. In this he was successful, but was himself caught by the train and killed. When the applicant, who had fallen clear of the line, recovered consciousness, he assisted the other workmen to carry the body of the foreman to a cabin. Subsequently he did light work, but still complained of pain in his hand. He was paid 13s. 4d. per week compensation till April 28th, and he was paid off, as there was no further work for him, on May 30th. He had done no work since.

Applicant bore out this statement, and said he had not been able to live on the half-pay allowed him, as he had a wife and four children.

Cross-examined by Mr. Barrington Ward, Applicant said he had resumed work for one month in May, but he felt that he was unable to do his work as he ought to—on several occasions he was told to stand by, and other men finished the job.

Mr. Ward: Have you tried to get work since May 30th?

Applicant: No, I haven't, for I could not do it.

Medical evidence was led to prove that the applicant's neurasthenic condition was due to the electric shock, and for the respondents, doctors said that this condition was evolved by want of work and mal-nutrition.

Haines, the foreman, said that when Lupton applied to be reinstated on June 2nd he seemed as fit for work as before. He then complained that he had been unjustly discharged owing to the accident—this was untrue.

Dr. Granger Stewart, nerve specialist, gave it as his opinion that the applicant had recovered from the electric shock.

His Honour found that Lupton had not completely recovered from the shock of the accident, and awarded him full compensation to September 19th and 5s. per week afterwards till further order.

Barton *v.* Lancashire Brass Founders, Ltd.

At Blackburn County Court, on December 9th, Thos. Barton, electrician, sued defendants, of Blackburn, for £39 10s. 11d., representing balance of an account for goods supplied. For plaintiff it was stated that in April Mr. Gardner, defendants' managing director, ordered a 15-H.P. motor, to cost £40, but, on Mr. Barton's advice, saw a 20-H.P. motor, to cost £55. Mr. Gardner thereupon went to Mr. Barton's premises, saw a 20-H.P. motor, and ordered it. Some dispute subsequently arose, and until this was settled defendants refused to pay the account, which, with accessories, amounted to £78 0s. 11d. in full.

For the defence, it was stated that the claimant advised a 15-H.P. motor, and defendants relied upon his judgment. They ordered a 15-H.P. motor, and had not varied their instructions.

Judge Sturges, in giving a verdict for the plaintiff for the amount claimed, said that in the delivery-note, and in correspondence which followed, it was stated that a 20-H.P. motor was supplied, and yet defendants did not protest. Defendants accepted what was sent, and there was no evidence that the motor was unfit for its work.

The Osram Lamp Works, Ltd., *v.* Corona Lamp Works, Ltd.

An application for the postponement of this patent action was in the list for hearing, with the cross-examination of witnesses, before Mr. Justice Sargant, in the Chancery Division, on Monday, December 14th.

The application, however, was not made, as by arrangement the hearing was fixed for January 21st next.

Claim against Edinburgh Corporation.

The First Division of the Court of Session disposed of an appeal from Edinburgh Sheriff Court in an action by a householder against Edinburgh Corporation for £100 damages for injuries sustained through missing her footing and falling while ascending the common stair to her house. She explained that the stair was at one time lighted by gas, but the defenders removed the brackets and substituted electric lamps, which could only be lit by keys in their possession or by automatic clock switch. The defenders, she said, were paid to light the stairs, but were in fault in negligently failing to do so on August 2nd.

For the Corporation, it was pointed out that owing to a latent defect in the clock it failed to work on the evening in question. They received intimation at 9 45 in the evening that the lights were not burning, and they at once had the clock repaired. They did not know until they received that intimation that the stair was dark.

The Sheriff dismissed the action as irrelevant, with expenses to the defenders, and it was against this decision that the householder appealed.

The Court of Session has now affirmed the interlocutor of the Sheriff, with additional expenses. The Lord President said that, so far as he could see, there was no relevant averment of fault on record. It was not alleged that the clock, having been out of order, and the defenders' attention having been called to that fact, that they neglected to put the clock in order, and so actuate the electric apparatus which lighted the stair. The pursuer being on her own stair, and seeing it was dark, was bound to take heed of her footsteps, and if she was unable to go up or down the stair without a light, to strike a light. The other Judges concurred.

British Thomson-Houston Co. *v.* The Electric Trading Co.

This patent action came before Mr. Justice Neville, in the Chancery Division, on Friday, December 11th, upon a motion for judgment in default of appearance by the defendants.

Mr. Ernest Lunge, representing the plaintiffs, said that every effort to serve the defendants with the writ had failed, and eventually the plaintiffs obtained an order for substituted service. That order had been complied with, but the defendants had not entered an appearance. The action was brought in respect of an alleged infringement of the plaintiffs' patent for electric incandescent lamps. Sale of infringing lamps was proved, and particulars of breaches had been filed with the statement of claim. By the minutes of the proposed order the Court was asked to grant an injunction, direct an inquiry as to damages, or, in alternative, an account of profits, delivery up on oath of the infringing lamps in the defendants' possession, and payment to the plaintiffs of the costs of the action.

His Lordship made an order in the terms of the proposed minutes.

Marconi Co.'s Memorandum.

In the County Court, on Tuesday, December 15th, Mr. Justice Neville had before him petitions by the Marconi Wireless Telegraph Co., Ltd., the Marconi International Marine Communication Co., Ltd., and the Wireless Press, Ltd., for the sanction of the Court to an alteration in their memorandum and articles of association.

Mr. Sheldon, who, instructed by Messrs. Coward & Hawkesley, Sons & Chance, appeared in support of the petition, said that it was presented under the alteration sections of the company's Act, and they were merely asking for confirmation of alterations by way of an additional clause which would allow the companies to establish a pension scheme, and to subscribe to charitable institutions.

There was no opposition, and his Lordship sanctioned the alteration as asked.

Slander Action.

Before Mr. Justice Coleridge and a Special Jury in the King's Bench Division, after some days' hearing, Mr. F. H. Haviland, of Bournemouth, has been awarded £200 damages against Mr. C. D. Willard only, judgment being given in favour of the other defendant, Mr. H. A. Treble, in respect of a claim for alleged conspiracy to libel and slander plaintiff in connection with a report to shareholders of the North-Eastern Electric Smelting Co., Ltd., of which they were all directors. According to reports in the *Financial Times*, the printed libel was to the effect that a director had been paid travelling expenses other than for the purpose of attending board meetings, and at a meeting it was said that Mr. Haviland's resignation had been asked for, and that he had resigned.

BUSINESS NOTES.

Desk Companion.—Messrs. Bruce Peebles and Co., Ltd., of Edinburgh, have again issued to their friends their annual desk companion. In the reference book which is again placed at the right of the blotting-pad, there is a diary for 1915, and a calendar for 1916; also abridged specifications, price lists and illustrations of the firm's manufactures. A complete and handy calendar for 1915 appears along the top border of what is undoubtedly a most serviceable and acceptable companion.

Catalogues and Lists.—The British Prometheus Co., Ltd., Salop Street Works, Highgate, Birmingham.—Two new catalogues containing illustrations, prices and brief particulars, of a variety of designs of electric heating apparatus. One of the publications (No. 150) contains 60 pages relating to convectors in polished copper and brass, hand-beaten copper and brass, antique copper and brass, hammered iron and other finishes, in most pleasing styles for all classes of service, also ships' heaters, log fires, &c.; a lamp radiator section shows a good selection of luminous radiators. The second publication (No. 165) gives, in the course of 20 pages, a description of the Prometheus electric fires employing "Noblechrom" and "Plebechrom" resistances, fire-bar and tubular elements being well illustrated. Five different designs of these fires are particularised—The Buckingham, St. James, Windsor, Balmoral and Holyrood.

Messrs. Alfred Herbert, Ltd., Coventry.—Eight-page illustrated pamphlet describing the Coventry chuck.

The Osram Lamp Works, Hammersmith, W., have prepared what we consider the most effective lamp-poster that they have yet produced. The Navy is the central subject, and that fact alone strikes home to the imagination and the heart in these very stirring times. Several of our vessels are shown under full steam, ready for action. An Osram drawn-wire lamp, brilliantly illuminated, is suspended from the mast, and gives the title, "The Leading Light." The colouring is well chosen, and admirably executed.

Messrs. Siemens Bros. & Co., Ltd., Woolwich, London, S.E.—Pamphlet No. A705, describing the Siemens luminous helm indicator.

Western Electric Co., Ltd., North Woolwich.—Leaflet No. 24, illustrates and prices the Triangle toaster stove and the Triangle electric iron.

Edison & Swan United Electric Light Co., Ltd., Ponder's End.—Leaflet No. F 3,082 is an 8-page price list of Ediswan electrical presents for Christmas and the New Year—electric radiators, Huntalite candle standards, adjustable floor standards, "Imperial" suction cleaners, electric ketties, stoneware jugs, hot-plates and flat-irons. Numbers of these lists can be furnished overprinted to the trade.

Messrs. Simplex Conduits, Ltd., 116, Charing Cross Road, London, W.C.—The first copy of a new series of *Installation News* contains, among other features of its 24 pages, an article illustrating and giving prices of a variety of Simplex Christmas gifts—electric kettles, toasters, electric irons, hair dryers, electric blowers, vibrators, curling tong heaters and Plexsim electric heat projectors. Other features of the pamphlet are notes on wiring for yard lighting and a description of the "Brilliant" suction cleaner. A Roll of Honour of employés of the company serving with the Colours (66 in all) is enclosed.

Messrs. Davidson & Co., Ltd., Sirocco Engineering Works, Belfast.—Bulletin No. 2,031 (8 pages) contains an excellently illustrated description of the "Sirocco" air washer for cooling turbo-generators and for purifying the air supply for buildings.

Cie. Francaise Pour la Fabrication des Lampes Electriques a Incandescence, 34, Rue Godot de Mauroi, Paris.—Circular showing particulars of candle-powers and voltages of their "A L A" metal-filament lamps. The company has been in existence for 14 years, and its manufactures and organisation are French throughout.

Messrs. Drake & Gorham, Ltd., 66, Victoria Street, London, S.W.—The firm has issued a handy DG pocket war map of France, Russia, and Austro-Serbia. References to some of the firm's manufactures and a list of addresses of their various branches are given.

The Hotpoint Electric Heating Co., 59, New Oxford Street, London, W.C.—Folder containing small illustrations and prices in dollars of a variety of Hotpoint electrically heated appliances.

Messrs. Ferranti, Ltd., Central House, Kingsway, London, W.C.—Binder containing a number of recently issued illustrated price lists of switches and fuses. The contents deal with knife switches for up to 650 volts, isolating switches for H.T. and E.H.T. circuits, totally enclosed ironclad switches and fuses, combined interlocked ironclad switch and fuse panels, low-tension fuses, time-limit fuses, H.T. fuses for potential transformers, and liquid resistance cut-off.

The General Electric Co., Ltd., 67, Queen Victoria Street, E.C.—Catalogue Section "R" of Robertson carbon lamps for all purposes, including new prices for lamps with bulbs of coloured glass, the cost of which has increased. Also *Bulletin*, No. 8, of Colliery and Mining Machinery, Part II., which will be dealt with in a later issue.

Dissolutions and Liquidations. — Leitner Electrical Co., Ltd.—The statutory first meetings of the creditors and shareholders were held recently at the Carey Street offices of the Board of Trade. Particulars of the failure appeared in our last issue.

Mr. W. J. Warley, Official Receiver, reported that he had received a proof of debt for £23,483 from Mr. Henry Leitner, and he was prepared to admit it at £10,000 for the purpose of voting at that meeting. Mr. Leitner claimed to have lost a considerable sum in respect of contracts which had not gone through, and he also claimed £5,000 under his agreement with the company to be employed as managing director for seven years at £1,000 per annum salary.

Mr. Leitner's representative said he would agree to the proof being admitted at the moment for £10,000.

The chairman said it was hoped when the company was brought to the Court that it would have been possible to sell the business as a going concern, but that hope had long since fallen through, and all that now remained to be done was to wind up the company. The business of the meeting was to decide upon the appointment of a liquidator and a Committee of inspection. The history of the company had been printed and circulated among the creditors and

shareholders, and having regard to the fact that some feelings of resentment had been exhibited by the various parties interested, he thought no good purpose would be achieved by dwelling upon matters of the past.

A creditor asked to be informed of the price obtained for the company's property at Woking.

The chairman explained that only a portion of the property had been sold, and some considerable trading of a sort was being carried on. The site had been taken possession of by the mortgagees, but he could not say whether it had been sold.

A creditor: It has not.

In reply to another creditor the chairman said the special manager, Mr. William Wyon, was appointed on July 28th, 1914. The subsequent trading showed a gross profit of £1,068, and a net profit of between £500 and £700. The orders in hand last July amounted to between £4,000 and £4,500. The question of the personal liability of the directors would be considered by the liquidator.

Mr. G. E. Corfield, chartered accountant, and the Official Receiver were nominated for the post of liquidator, and the chairman announced that the appointment would be made in due course by the Registrar.

The following are creditors:—

Accumulator Industries (in liq.)	£500	Micanite and Insulators Co.	£27
" " "	328	Midland Electric Wire Co.	63
Armstrong, Stevens & Son	34	Morgan Crucible Co.	77
Baird & Tatlock	11	Newtons, Ltd.	569
Baxter, J. M., & Co.	10	Peters, G. D., & Co.	2,136
Booth, J., & Co.	16	Pilkington Bros.	162
Brimsdown Lamp Works	126	Pirelli, Ltd.	58
British Xylonite Co.	57	Princes Street Estate Co.	109
Buck & Hickman	269	Redfern, G. F., & Co.	287
Callender's Cable Co.	289	Sankey, Joseph, & Sons	99
Churchill, C., & Co.	1,449	Saller & Co.	14
Coan, R. W.	15	Simmonds Bros.	138
Concordia Elec. Wire Co.	31	Simplex Conduits, Ltd.	24
Cope & Co.	21	Skeet-Fookes & Jeffs	73
Craven Bros.	63	Skefko Ball-Bearing Co.	37
Drake & Gorham	48	Sulley, J. & A. W., & Co.	126
Drowley, G. F.	246	Tagart, Morgan & Coles	44
Dryers, Ltd.	86	Tylor & Sons	111
E.M.F. (1914), Ltd.	26	Veritys, Ltd.	65
Everett, Edgcumbe & Co.	14	Westinghouse Cooper-Hewitt	126
Eversheds & Vignoles	33	Westminster Engineering Co.	92
Fuller Elec. Manufacturing Co.	21	Willans & Robinson	89
Gerhard & Hay	967	Wilcox, W. H., & Co.	45
Greenwood & Batley	1,992	Woking Electric Supply Co.	52
Grundy, J.	202	Worsnop & Co.	11
Hasted, J., & Son	16	Armstrong, A. A., Major	106
Hales Owen Steel Co.	26	Leitner, H.	126
Herbert, A., & Co.	663	" "	826
Hill, F. A., & Co.	20	" "	246
Hoffmann Manufacturing Co.	196	" "	1,370
Humphreys, Ltd.	147	Stone, J., & Co.	930
Lees, W., & Co.	23	" "	8,070
Leyendecker & Co.	157	Sturdy, P.	306
Locke, Lancaster & Co.	321	Hollings, P.	150
London Die Casting Foundry	130	Leitner, H.	5,000
London Electric Wire Co.	178	Ledward, H.	408
McLaren, W.	252	Colles, F. J.	37

ELECTRIC UTILITY CO., LTD.—This company is winding up voluntarily, with Mr. A. Jonckheere, of 9/10, King Street, E.C., as liquidator. A meeting of creditors is called for December 23rd.

READER'S PATENTS AND ENGINEERING CO., LTD.—This company is winding up voluntarily, with Mr. E. W. C. Whittaker, of 3, Portland Street, Southampton, as liquidator. A meeting of creditors is called for December 21st, at 50, Gresham Street, E.C.

Book Notices.—"The Dynamics of Surfaces." By Prof. L. Michaelis. London: E. & F. N. Spon, Ltd. Price 4s. net.

"Magnets and Electric Currents." By Prof. J. A. Fleming. London: E. & F. N. Spon, Ltd. Price 3s. 6d. net.

"The Elements of Electro-Plating." By J.T. Sprague. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net.

"The Colliery Managers' Pocket Book, Almanack and Diary for 1915." By H. Greenwell. London: *The Colliery Guardian* Co., Ltd. Price 2s. net.

"*Bulletin* of the Bureau of Standards," Vol. X, Nos. 2 and 3. "Flame Standards in Photometry." "The Silver Voltameter," Part IV. "Testing Potential Transformers." "Production of Temperature Uniformity in an Electric Furnace" "Combustion Method for the Direct Determination of Rubber." "Electric Lights for Use about Oil and Gas Wells." "Permissible Electric Lamps for Miners." "Factors Governing the Combustion of Coal in Boiler Furnaces." Washington: Government Printing Office.

"Science Abstracts." Sections A and B. Vol. XVII, Part 2. November 30th. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"American Handbook for Electrical Engineers." By H. Pender. London: Chapman & Hall. Price 21s. net.

"Electrical Engineering in India." By J. W. Meares. London: W. Thacker & Co.

"Magnetism and Electricity." By S. S. Richardson. London: Blackie & Son, Ltd. Price 4s. 6d.

"The *Mechanical World* Electrical Pocket-Book for 1915" (Manchester: Emmott & Co., price 6d.) contains new matter on electric circuits and switching, synchronising and phasing-out, troubles with A.C. machines and the remedies for them, &c., and existing sections have been re-written and extended. There is an extraordinary variety of information in this inexpensive book.

"*Journal* of the Institution of Electrical Engineers." Vol. LIII, No. 238. December 15th, 1914. London: E. & F. N. Spon, Ltd. Price 3s. 6d.

"Model Answers to Test Questions in Wireless Telegraphy." Series 2. London: The Wireless Press, Ltd. Price 1s. net.

Bankruptcy Proceedings.—WILLIAM HENRY WOOD, electrical engineer, Lorna Doone, School Lane, Hall Green, Birmingham, Warwick.—The first meeting of creditors was held at 191, Corporation Street, Birmingham, last week, when the statement of affairs showed liabilities amounting to £470, and assets estimated to produce £1,229, the estate disclosing an apparent surplus of £759. The debtor did not consider himself to be insolvent, but stated that owing to the action of a limited company, of which he was managing director, in refusing to pay his salary, and in making an illegal call on shares, he had been forced into such a position that he could not immediately meet his liabilities, but his assets more than covered them. It appeared that the debtor was formerly employed as a departmental manager of a firm of electrical engineers, his salary towards the termination of such employment being at the rate of £400 a year. In October, 1912, the debtor acquired the lease of half an acre of land at King's Road, Tyseley, and commenced to erect a factory thereon, mortgaging the building and plant in order to do this. In conjunction with another he promoted a limited company in April, 1913, to carry on the business of electrical engineers, with a nominal capital of £8,000. As vendor the debtor received £100 in cash and 500 fully paid up deferred shares of £1 each. He further subscribed for 1,000 ordinary shares, upon which he paid up £666, with the assistance of moneylenders. Debtor was appointed managing director at a yearly salary of £350. Disagreements arose, and in January of the present year the debtor ceased to attend the business, and subsequently brought an action against the company for breach of contract. The company raised a counterclaim, and although negotiations had been commenced for a settlement, they had as yet produced no result. In June of the present year debtor with another floated a small private limited company, with a nominal capital of £2,000, the objects of the company being the manufacture of motor fittings and metal work for the motor trade. In consideration for his services to the company debtor was allotted 130 shares, and was still acting as managing director at a weekly salary of £4 and 20 per cent. commission upon the profits. It was decided that an application should be made for the debtor's adjudication, and Mr. G. W. Blackham was appointed trustee, with a committee of inspection.

W. R. WEDGE, electrical engineer, The Arcade, Northampton.—The adjourned public examination of this debtor was fixed to be held at the County Hall, Northampton, on December 8th, but when the case was called the debtor failed to put in an appearance. The Official Reviewer stated that he had informed the debtor that it was likely that the case would be adjourned *sine die*. A letter had been received from the debtor in which he stated that he hoped to be employed at Bedford in the New Year, and he would then be in a position to attend the Court. The Official Receiver said that in an ordinary case he would have asked for further adjournment, but the debtor had been fencing. If a further adjournment were ordered he suggested that the debtor be informed that the case would be adjourned *sine die* unless an appearance was made. The Registrar agreed and ordered an adjournment.

HENRY H. OXLEY (Oliver Huxley), consulting engineer, Hanwell.—Last day for receiving proofs for dividend, December 30th. Trustee, E. W. J. Savill, 14, Bedford Row, W.C.

GEORGE EDWARD HIPKINS, 48, Wolverhampton Street, Dudley, Worcester, electrical engineer.—The receiving order herein was made on the debtor's own petition, and according to the accounts prepared the liabilities amount to £508, and the assets are estimated to realise £122, the estate disclosing a deficiency of £386. It appears that the debtor started trading on June 2nd, 1913, with a capital of £455, being the value of a house at West Smethwick £490, less the amount of his liabilities about £35. The deeds of the property were deposited with the bank, who agreed to allow the debtor an overdraft of £450. The property was sold for £490 in July, 1914, and the proceeds, less expenses, were used to pay off the bank overdraft. Debtor has kept day books and sales ledgers, but no cash book has been kept. The failure is due to loss on trading through the war, law costs, interest on borrowed money, &c., and debtor admits knowledge of his position since November 20th last. The first meeting of creditors in this matter was held at the Official Receiver's offices, 1, Priory Street, Dudley, last week, when the case was a summary one, and was left with the Official Receiver.

Dinners.—The annual dinner of the staff and employés of the WESTMINSTER ENGINEERING CO., LTD., was held at Willesden Junction Hotel, on Saturday evening last, Mr. J. O. Girdlestone presiding. A considerable number of the company's contingent now serving with the Colours were the guests of the evening, and naturally they had a most enthusiastic reception. A smoking concert followed. The evening was a great success, and we are assured that that success was largely due to the excellence of the musical talent provided by the Hon. Sec., Mr. F. G. Brown, and other members of the firm.

The staff of the instrument department of the BRITISH WESTINGHOUSE WORKS, at Trafford Park, held their eighth annual dinner recently at the Wheatsheaf Hotel, Manchester. Mr. J. Kennedy presided, and, following the dinner, an enjoyable musical programme was carried out by Messrs. Fred Hamer, Smith, A. Wilson, H. Compton, G. Hallam, R. Ogden, G. Wiseman, J. Clarke, E. Rodgers and W. Alcock.

Trade Announcements.—The registered offices of the CHURCH STRETTON ELECTRIC SUPPLY CO., LTD., have been removed to 1C, King Street, St. James's, London, S.W.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., announce that their London telephone numbers have been altered to "442 and 443 Victoria."

MESSRS. SCHOLEY & CO., LTD., announce that on and after December 24th their address will be 56, Victoria Street, Westminster, S.W. Telegrams: "Scolanco Sowest London." Telephone: Victoria 6663 (two lines).

Canada.—H.M. Trade Commissioner in Canada reports that a Montreal agent who has hitherto represented German and Austrian firms wants to secure the representation of the United Kingdom manufacturers of tungsten lamps and electrical fittings. A Winnipeg firm wants to represent British makers of porcelain telegraph insulators. Another Winnipeg firm wants to represent British makers of electrical supplies and specialities. The name and address in each case can be obtained from the Board of Trade Commercial Intelligence Department, in London.

Financier Wanted to Develop an American Scheme.—A correspondent in California is anxious to get into touch with some individual or syndicate or company prepared to undertake to develop a 25,000 to 30,000 hydro-electric power in one of the Western States, on the basis of, say, a 20 to 30-year lease of the said water rights, and pay a yearly rental for same on the basis of $4 per H.P.-year. "The company or syndicate could easily clear $50 per H.P.-year for all the power they could generate and transmit to the consumer. Transmission to excellent market at 60 miles, and many other points between."

LIGHTING and POWER NOTES.

Altrincham.—Street Lighting.—Mr. R. H. Hooper held a L.G.B. inquiry on December 9th with reference to the application of the U.D.C. for sanction to borrow £675 for electric street lighting in Ashley Road, George Street, Kingsway, Railway Street, and Stamford New Road. It transpired during the inquiry that the Council had never had before it precise figures as to what the proposal would cost, although the work had been commenced, and this was described by Mr. Hooper as unbusinesslike. In the end, the clerk intimated that he would bring before the Council for decision the question whether or not the application should be proceeded with.

At a special meeting of the Council on Monday, it was decided that the application should be withdrawn, and the matter reconsidered six months hence.

Ashton-on-Mersey.—The Altrincham Electric Supply, Ltd., has notified the U.D.C. of its intention to apply for additional powers in the next Session of Parliament.

Ashton-under-Lyne.—The Electricity Committee has expressed approval of the I.M.E.A. proposals, but has deferred any further action pending information as to the number of other authorities likely to join in the promotion of the Bill suggested.

Barnes.—The Electricity Committee reports that it is proposed to give a supply of current to Messrs. Watney, Combe and Reid's Mortlake Brewery, at 1d. per unit on the basis of a supply of 80,000 units per annum, the maximum demand being 35 KW. and a contract for five years, and to light the dwellings the company proposes to erect in Marne Road, at 26s. each cottage per annum.

Barnsley.—The T.C. has sanctioned the purchase of an oil separator for use in conjunction with the turbine condenser at the electricity works, at a cost of £175.

Blackpool.—L.G.B. Inquiry.—On December 11th, an inquiry was held into an application by the Corporation to borrow £5,400 for the purchase of property to enable extensions to be carried out at the electricity works. Mr. Furness, electrical engineer, said Blackpool was not favourably situated for the use of seawater for condensing purposes, which would require an outlay of something like £25,000. He further stated that the output of electricity had increased from 3,000,000 units in 1907 to 5,000,000 last year.

Bolton.—Plant Extensions.—The electrical engineer has been instructed to report further as to the additional engine and boiler, switchgear and reservoir accommodation likely to be needed at Back-o'-th'-Bank, together with the cost.

Bradford.—Restricted Lighting.—Local shopkeepers, who have for some time past been compelled to extinguish all outside lights at eight o'clock every evening, are now permitted to maintain them until 8.30 on Mondays, Tuesdays, Wednesdays and Thursdays, nine o'clock on Fridays, and ten on Saturdays, provided that they are hooded so as to reflect the light into the window and not on to the pavement.

Castletownbere (Co. Cork). — E.L. Scheme. — A public meeting having approved of an electric lighting scheme for the town, the local Council has ordered steps to be taken in the matter without delay. Lamps of from 30 to 50 C.P. are to be used in the installation.

Continental. — Italy.— The Cantonal authorities of Ticino have requested leave from the Swiss Federal Council to sanction the export of electrical energy to the extent of 10,000 H.P. into Italy. The Swiss Railways Direction has no objection, providing the rights of the Railway Direction are recognised, to draw such energy from the output of the Canton of Ticino, as may be required for the working of the Saint Gothard line.

Ealing. — Restricted Lighting. — In view of the earlier closing of shops the T.C. has decided to reduce the annual charge for each pair of outside arc lamps, from £10 to £9 10s., in those cases where they are extinguished half an hour earlier each day.

Epsom.—School Lighting.—The U.D.C. has decided to extend the mains in order to supply current to Epsom College, subject to a three years' agreement and a minimum annual consumption of 3,000 units. When the College is completely equipped the consumption will be from 15,000 to 20,000 units per annum.

Greasbro.—Suggested E.L.—The U.D.C. has decided to ask Earl Fitzwilliam whether there is any likelihood of his Lordship supplying electric lighting for the district.

Greenock.—Proposed Loan.—The Corporation Electricity Committee proposes that application be made to the Secretary for Scotland for power to borrow £30,000 to enable it to meet the increasing requirements of the department. Extensions of the supplies to local works, as well as to the neighbouring town of Port-Glasgow, are expected.

Hindley.—The U.D.C. has decided to notify consumers obtaining electricity from the Lancashire Electric Power Co. that their supply will be taken over by the Council within one month. The prices suggested by the company for the supply of electricity to picture palaces have been adopted, viz., lighting, 4d. per unit; power, 2½d. for current supply for lantern. Suggestions for the supervision of the electricity undertaking are to be submitted to a future meeting.

Hythe (Kent).—Restricted Lighting.—On account of the reduced lighting owing to the war, the Folkestone Electricity Co. has allowed the T.C. a rebate of £180 on the lighting contract.

Keighley.—Loan Sanction.—Of the £500 for which sanction was applied for by the T.C. in respect of excess expenditure on boilers and water tower at the electricity works, the L.G.B. has sanctioned £443.

Lanarkshire. — Blantyre Supply. — The County Council has been notified by the general manager of the Clyde Valley E.P. Co. that a suitable site for a sub-station has been obtained in Blantyre. The Council has approved of the scheme, and agreed that an additional cable be laid to provide public lighting, should that be required in the future.

Liverpool.—New Plant Started.—On Friday last, at the annual inspection of the lighting and tramways undertaking by the Tramways, Electric Power and Lighting Committee, a new B.T.H. 6 000-KW. turbine set was started up at the Lister Drive station by the chairman of the Committee, Mr. E. Russell Taylor. Another machine of similar size and type is being erected, and a further one is projected, which will have the effect of increasing the plant capacity of 17,000 KW. to 35,000 KW. The opportunity was also taken to inspect the new boiler plant and various sub-stations, of which the city possesses 14. Contrary to usual custom, the inspection took place late in the afternoon, and subsequently the company, which included the Lord Mayor, Mr. S. E. Rayner, dined together at the Midland Adelphi Hotel. During the evening Alderman Fred Smith, vice-chairman of the Committee, proposed the toast of "The Electrical Engineer," in appreciative terms, referring to the work which the department had carried out recently. "While the Committee really did it all, he did not mind admitting that Mr. Dickinson did a bit." Mr. Dickinson, city electrical engineer, in responding, paid a tribute to the services rendered to the undertaking by Mr. Bromley Holmes, who had designed the buildings in such a way that they had been able, without adding to them, to quadruple the generating capacity with modern plant. He was satisfied that there was great scope for extending the power load in the city, but it would take time. Liverpool power users had not appreciated the benefits of electric driving in the past. They had spent in alterations and new plant at Lister Drive some £75,000, and they had done it out of revenue. He was absolutely certain that the results would come out all right. We hope in our next issue to describe and illustrate the new plant referred to.

London.—Restricted Lighting: New Order.—A new order, which supersedes the Home Secretary's original order which expired at the end of the month, has been issued as follows:—"The use of any lights whatever for outside advertising or for the illumination of shop fronts is now prohibited." Formerly only "powerful" lights were prohibited, and the uncertainty as to what lights were powerful led to evasions of the order.

Electricity Supply.—At the meeting of the L.C.C. on Tuesday, the Parliamentary Committee submitted for approval the London and District Electricity Supply Bill, 1915, which will give effect to the scheme contained in the report to the Council in November last. Details of the proposal have already appeared in our pages. The representation on the authority will be on the basis of assessable value, 27 representatives being provided for, of which 18 will represent the L.C.C. and the remainder the various county and borough councils concerned.

The Bill provides, however, that the members of the Authority need not be members of the appointing body, but the Local Government Committee expresses the view that, having regard to the very large financial and other interests of the County of London in the scheme, an absolute majority (say 14) of the Authority should be members of the L.C.C. The Parliamentary Committee, however, is afraid that this proposal might give rise to criticism, and it further holds that the Council should have greater latitude in the choice of representatives. All that this Committee proposes, therefore, is that not less than half of the representatives of the Council should be members of the L.C.C

The maximum price for bulk supply or for power supply to any body, company, or person owning or working a railway, tramway, canal, navigation, docks, or waterworks is not to exceed a fixed sum of £3 10s. a KW. of the maximum power required, and 0·25d. a unit.

The Authority is empowered to expend not exceeding 10 million pounds. This, it is thought, would probably cover the outlay for capital purposes during a period of ten years after the works have commenced.

With the object of securing the ultimate unification of electricity supply within the area, the Bill provides that, after 12 months from the passing of the Act, it shall not be lawful for any authorised undertakers, except with the consent of the Authority, to extend any distributing system otherwise than in accordance with such standards of periodicity, voltages, and systems for the transmission, distribution and supply as the Authority may prescribe; or to erect any new generating station or to increase the generating capacity of any station beyond a certain limit.

The original scheme provided that the powers sought should lapse if, within five years from the passing of the Act, no contract was made between the Authority and a company, and no substantial steps were taken in respect of the new undertaking, but it is provided in the Bill that only those powers which would have been transferred to the company shall lapse.

At the meeting of the Council approval was given after a long discussion to the Bill. The scheme has been amended to provide that 14 out of the 18 representatives of the L.C.C. shall be members of that body. The Parliamentary notice of the Bill is also to be altered to give the authority itself power to work the undertaking.

ST. PANCRAS.—LOAN PERIODS.—The Electricity Committee reports that as a result of the interview with the L.C.C. Sub-Committee, it is very unlikely that the reduction of the outstanding loan periods as proposed by the County Council's Committees will be further pressed.

Lowestoft.—The T.C. has revised the charges for current for power as under:—Cinemas and similar shows, 2d. per unit up to 2,000, and 1½d. beyond; consumers over 50,000 units per annum, $1\frac{3}{16}$d. per unit; all accounts to be subject to 5 per cent. discount for payment in one month.

Lytham.—BULK SUPPLY.—Negotiations are still in progress between representatives of the Lytham and St. Anne's Councils regarding the matter of the supply of electricity in bulk to Lytham. The proposed agreement is for 10 years, ending in 1925.

Newbridge (Co. Kildare).—PROPOSED E.L.—The Town Commissioners are considering as to the advisability of installing an electric lighting system for the town.

Newcastle-under-Lyme.—LOAN SANCTION.—The T.C. has received L.G.B. sanction to a loan of £1,350 for cable extensions, the provision of a storage battery, &c., without the holding of an inquiry.

Nuneaton.—The T.C. has reduced the charge for current supplied to the Hospital and benevolent institutions to 3½d. per unit, and will lay duplicate services to consumers' premises when applied for, providing the consumer agrees to pay 20 per cent. per annum for five years of the cost of carrying out the work.

Penistone.—WORKHOUSE LIGHTING.—The B. of G. has received from the L.G.B. sanction to a loan for installing the electric light at the workhouse.

Riccall.—PROV. ORDER.—The Rural Council has been informed that the Yorkshire Electric Power Co. intends applying for a prov. order to supply electricity within the district. The company has been asked to send a representative to discuss the matter.

Sandgate.—RESTRICTED LIGHTING.—The Folkestone Electricity Co. has allowed the U.D.C. a reduction at the rate of £120 a year on the public lighting contract owing to decreased lighting through the war.

Scarborough.—RESTRICTED LIGHTING.—The severe restrictions as to lighting have been relaxed to some extent, a new order having been issued that until and including Christmas Eve shopkeepers will not be required to draw their blinds until 8 p.m., provided that their lights are shaded.

Sheffield.—SALE OF ELECTRIC FITTINGS.—The T.C., by 33 votes to 15, has adopted the recommendations of the Special Committee as to a showroom and the sale of electric fittings, &c., particulars of which have appeared in these columns.

Southport.—RESTRICTED LIGHTING.—The Electricity Committee, after further consideration of the restrictions of street lighting owing to the shortage of carbons, has decided to discontinue the arc lighting on the Promenade and to reduce the electric lighting in the borough by one-half.

Swansea.—The Corporation E.L. and Tramways Committee has arranged to supply current for lighting to the Rutland Street premises of the Mumbles Railway Co. A free supply of current is to be given to Sketty Hall, which is being used as a military hospital by the British Red Cross Society.

Taunton.—STREET LIGHTING.—The T.C. has arranged to pay £2,700 a year to the electricity department for public lighting, this being the average annual cost for the past six years.

Walsall.—LOAN SANCTION, &c.—The Electricity Committee has given notice of a revision of the price of energy on the tramways leased to the company as from December 31st next. The L.G.B. has sanctioned the borrowing of the following amounts in respect of the undertaking:—£10,280 for buildings, canal intake and waterways; £20,605 for turbines, &c., and switchgear; £25,242 for boiler house plant, coal weigher, crane and station transformers. The Electricity Committee has placed an order with the British Westinghouse Co. for three sub-station static transformers for £790.

Wednesbury.—L.G.B. INQUIRY.—Major J. Stewart, R.E., conducted an inquiry on Wednesday, last week, into the application by the T.C. for a loan of £2,146 for a rotary converter, transformers, the laying of cables and provision of a transformer station at King's Hill recreation ground. Electricity in bulk is to be purchased from the Midland Electrical Corporation. In the course of the inquiry it transpired that the Corporation plant was overloaded, and that inconvenience had been caused to local power users owing to deficiencies in the supply.

Whitworth.—LOAN SANCTION.—The L.G.B. has sanctioned the borrowing of the following sums in connection with the electricity scheme:—£7,700 (for first installation—new works, land, buildings, mains, plant, &c.) £2,000 (for prospective expenditure on mains); £300 (services); £200 (meters); and £750 (sub-station).

Wolverhampton.—The Electricity Committee recommends that a motor converter be repaired at a cost of £250, and that a new modern steel roof, with asbestos slate tiling, be erected to cover the older portion of the generating station, at a cost of £1,800.

Woodford.—The Council has been informed that the County of London Electric Supply Co., Ltd., is applying for a prov. order for the supply of electricity.

Ystradgynlais.—E.L. PURCHASE.—The D.C. has decided to purchase the undertaking of the Glantawe Electric Supply Co., at an agreed cost of £17,000, each party to defray its own expenses.

TRAMWAY and RAILWAY NOTES.

Barnes.—ELECTRICALLY-PROPELLED DUST VANS.—The surveyor to the D.C. reported that the trials of the two electrically-propelled dust vans have been very satisfactory, and showed that a large saving can be effected by their substitution for horse dust-carts. A full report is to be submitted at the next meeting.

Continental.—ITALY.—Tube railways are the order of the day in most large cities, and among the latest adherents to the vogue is Milan. The retiring Municipal Council appointed a strong Committee to draw up plans and specifications, and the newly-elected Council has reappointed the same Commissione della Metropolitana, with the addition of certain new members, with a view to bringing its labours to a practical ending.

Edinburgh.—After considering the draft agreement between the Corporation and the Edinburgh and District Tramways Co. in regard to the conditions which shall govern the taking over of the rolling-stock, &c., of the tramways by the Council at the end of the lease, the Tramway Committee of the T.C. remitted the matter to a Sub-Committee and the town clerk, with a view to further negotiations.

Emley.—A meeting is being held to consider whether the Huddersfield Corporation should be asked to extend the tramways to the district. The U.D.C. will be represented at the meeting.

Greasbro'.—The Rotherham Corporation has intimated to the U.D.C. its intention to apply for powers to introduce a motor-omnibus service between Rotherham and Greasbro'.

Hindley.—Representatives of the U.D.C. and the Wigan Corporation are to hold a conference, to consider the question of running a tramway service up Market Street.

Ilford.—YEAR'S WORKING.—There was a deficit of £3,567 on the working of the tramway undertaking last year, due to 'bus competition and increase in working expenses owing to extra mileage run. The tramway manager reports that the total working expenses are at the rate of 5·876d. per car-mile, or ·22d. less than in the previous year; nearly half a million more passengers were carried, but 54,000 extra miles had been run. The balance of the reserve fund had been reduced to £2,294, the 1d. rate in aid having only covered the withdrawals for special purposes during the year. The manager reports at the present time the receipts are now nearly £4,000 up, and he anticipates an increase of £5,500 on current year's takings. The increased expenditure on the Barking extension will be about £3,000, and extra expenditure on war allowances £1,000. The manager recommends abolishing the ½d. fares.

The Committee has instructed the manager to communicate with other towns where an alteration from ½d. fares had taken place and a universal 1d. fare adopted, with a view to ascertaining their experience.

Lanarkshire.—Proposed Tramway Purchase.—Overtures are proceeding between the County Council and the Lanarkshire Tramways Co., with a view to the former acquiring the tramways. The company has offered facilities for the inspection of the books, rolling stock and undertaking generally, at the request of the Council.

Lincoln.—Railless Traction Scheme.—The T.C. is applying for powers to run electrically-propelled railless vehicles along five routes in the city.

Liverpool.—Electric Railway Stoppage.—The service of electric trains on the Liverpool and Southport Electric Railway, and the Liverpool and Ormskirk service, were interrupted last Friday night through a failure of current at the main power station at Formby. Steam locomotives were secured to move the trains, and a curtailed service was subsequently maintained.

London.—L.C.C. Tramway Stoppage.—On Friday last, about 5 p.m., practically the whole of the L.C.C. tramway services were stopped owing to a breakdown at the Greenwich power station. The Forest Hill and Lewisham sections were not affected as they are supplied from the Deptford generating station of the London E.S. Co. The official explanation of the trouble so far given, is to the effect that a transformer blew up, throwing oil over a wooden staging which had been erected in connection with extensions now being carried out, and setting it on fire. The fire apparently burnt out the cable connections between the generators and switchgear, thus isolating the generating plant for the time being. The stoppage occurred at a time when the traffic is usually the heaviest, and the cars were left standing in the streets. One result was a period of heavy traffics for tube and underground railways, while additional 'buses were also called into service. On Sunday the car services had assumed a more normal aspect, although the complete service on all routes had not then been resumed.

Apparently the County of London E.S. Co. and the St. Pancras and Poplar municipal electrical departments also rendered assistance in restarting the services.

At Tuesday's meeting of the Council, the Chairman of the Highways Committee made a statement on the cause of the breakdown, pointing out that the transformer box had been in use some 10 years, and would have been discarded in another five days. The protective devices at the station adopted subsequent to the last accident had worked well, the only generators affected by surges being on the old reciprocating sets to be discarded, which had not been fitted with them. He added that the most effective way of preventing breakdowns would be the linking-up of London's electric supply undertakings.

Lambeth.—The B.C. has been notified that the L.C.C. tramway scheme, *via* New Cut, to link up Waterloo and Blackfriars, had been abandoned, owing to its opposition.

Hackney.—The B.C. has decided to urge the Stepney B.C. to agree to the L.C.C.'s proposal to reconstruct and electrify, on the overhead trolley system, the tramway between the West India Docks, &c., and Hackney. Three of the four B.C.'s concerned have already agreed to the proposal.

Southampton.—The Electricity and Tramways Joint Committee has decided to reduce the charge for tramway current for power purposes by one-eighth of a penny per unit, commencing the next financial year.

Walsall.—Tramway Extension.—The Corporation Tramways Committee proposes to proceed with the construction of a new length of tramways, at a cost of £3,683.

Weston-super-Mare.—The B. of T. has been asked to prolong the time limit for the completion of the unconstructed light railway authorised by the order of 1910, until December 31st, 1915.

Wolverhampton.—Tramway Extension.—The Council has entered into an agreement with the Bilston U.D.C. with reference to the construction of a tramway track in the district of the Council, from Ettingshall Lane to Stowheath Lane.

TELEGRAPH and TELEPHONE NOTES.

German Pirates.—The esteem in which the *Emden* has been held in this country has been somewhat damped by the report that the force which raided the cable station at Cocos Island robbed the cable staff of private property to the value of over £160.

Secret Wireless Stations.—The Santiago correspondent of the *Times*, in a dispatch dated November 9th and published on December 16th, states that there is every reason to believe that the German cruisers in the Pacific were able to obtain wireless information continually at points along the Pacific coast, and that such information was withheld from British warships. The Chilian Government maintained a strict observance of neutrality, and the illicit communication was the work of private installations.

Telegrams in Code.—From Monday last the three following codes have been authorised for use, in addition to the four previously authorised, subject to the conditions and arrangements already in force:—Bentley's Complete Phrase Code (not including the separate Mining and Oil Supplements); Broomhall's Imperial Combination Code (not including the special Rubber Edition); Meyer's Atlantic Cotton Code (39th Edition).

CONTRACTS OPEN and CLOSED.

OPEN.

Australia.—Sydney.—February 15th, 1915. Potentiometer, for the Municipal Council. Specifications (10s. 6d.) from the City Electrical Engineer, Town Hall.—*A. Mining Standard.*

March 15th. Municipal Council. Transformer testing apparatus. Specification from City Electrical Engineer. A copy can be seen at the Board of Trade C.I. Branch in London.

Adelaide.—January 20th. Telephone material, fuse, &c., for Postmaster-General. See "Official Notices" December 11th.

January 27th. Accumulators, and power board, for Postmaster-General. See "Official Notices" to-day.

Melbourne.—January 6th. Six 100-K.V.A. single-phase transformers. 7,230 yards of single conductor lead-covered cable, for the City Council. See "Official Notices" December 11th.

Bacup.—Tenders are to be obtained for a 100-KW. and a 50-KW. transformer, and also for wiring and fitting for electric lighting the municipal offices and other buildings belonging to various committees of the Coporation. A proposal to purchase an electric fire alarm for the fire station has been left with the Mayor and Ald. Lord.

Birkenhead.—January 12th. Twelve months' supply of electric motors and motor-starters, from ¼ to 15 H.P., for the Corporation electricity supply. See "Official Notices" to-day.

Dundee.—Corporation Electricity Department. Complete structural steel work for extensions to floors, &c., at Carolina Port generating station.

Dundalk.—December 21st. G.N. Railway (Ireland). Electric motors and accessories, sub-station switchboard, hard-drawn copper wire, bitumen wires. See "Official Notices" December 4th.

Easington.—January 9th. Guards (approved by the L.G.B.) for E.L. cables for public lighting, for the P.C.; Mr. W. Wiggham, acting clerk.

Elmton-with-Cresswell (near Mansfield).—December 21st. Extension of street lighting, with overhead wiring, for the P.C.; the Clerk.

Hong Kong.—January 15th. Two 1,500-KW. (2,000 K.V.A.), turbo-alternators with condensing plant and switchboards, E.H.T. cable, sub-station switchboards and transformers, for the North Point generating station. See "Official Notices" to-day.

Hornsey.—December 29th. E.H.T. switchgear and E.H.T. three-core cable, for the Borough Electricity Works. See "Official Notices" December 4th.

January 2nd. L.T. switchgear, &c, for the T.C. See "Official Notices" December 11th.

Johannesburg.—January 5th, 1915. Materials, renewals, &c., for tramway equipments, for Municipal Council.

Leeds.—January 22nd. Overhead electrically-driven travelling crane, coal and ash-conveying plant, for Electric Lighting Department. See "Official Notices" December 11th.

Leyton.—U.D.C. Repairs, &c., to cooling tower, for Lighting Committee. See "Official Notices" to-day.

Lincoln.—E.L. installation, Mount Street Schools, for the T.C.; Mr. W. G. Watkins, architect.

Manchester.—December 21st. Corporation. Three reactance coils, for generating station. See "Official Notices" December 4th.

Nottingham.—December 28th. Electric motor and laundry plant for the B. G. Mr. J. A. Battersby, clerk, Shakespeare Street.

Spain.—December 28th. The municipal authorities of Villel (province of Teruel) are inviting tenders for the concession for the electric lighting of the town during a period of ten years.

Tenders have just been invited by the municipal authorities of Esguevillas (province of Valladolid) for the concession for the electric lighting of the town during a period of six years.

Walthamstow.—December 23rd. U.D.C. 1,500-KW. turbo-alternator, 600-KW. triple-expansion engine and dynamo, 1,000-KW. rotary or motor-converter. See "Official Notices" December 4th.

CLOSED.

Ashton-under-Lyne.—The E.C. has accepted tenders for the supply of coal for the electricity works during the ensuing 12 months, the New Moss Colliery Co., Ltd., to supply two-thirds and Mr. Herbert Johnson one-third.

Australia.—The following tenders have been accepted :—

P.M.G.'s Department, N.S.W.—
Telephone cable (Schedule 419).—Western Electric Co. (Aust.), Ltd., £1,454; British General Electric Co., £961.
Telephone Accessories (Schedule 408).—J. Paton & Co., £813; Western Electric Co. (Aust.), Ltd., £1,543; Laurence & Hanson Electric Co., Ltd., £214; A. J. Todd & Co., £859.
P.M.G.'s Department, Victoria.—
Cable distributing boxes (Schedule 1,065).—W. T. Henley's Telegraph Works Co., Ltd., £214.
Sulphate of copper (Schedule 1,142).—S. R. O. Allen, £4,456.
P.M.G.'s Department, Queensland.—
Telephone accessories (Schedule 293).—Western Electric Co. (Aust.), Ltd., £238.
Melbourne City Council.—
Recording meters.—Ediswan & Swan U.E.L. Co., £524; Ferranti, Ltd., £196; Reason Manufacturing Co., £816; Standard Waygood Hercules, Ltd., £171.

Bacup.—In connection with the electric lighting of the Police Buildings, the tender of Mr. G. L. Adamson has been accepted.

Cunard Co.—The Edison & Swan United E.L. Co., Ltd., has received the lamp contract for the supply of Royal Ediswan lamps for the next year's requirements for the Cunard Steamship Co.

Heywood.—The T.C. has accepted the tender of Messrs. Blakely & Wild for extensions at the electricity works buildings, and that of Mr. Samuel Barker for the erection of a sub-station at Heap Bridge. Tenders for machinery required at the electricity works have been referred to a future meeting.

Keighley.—The Electricity Committee has accepted the tender of Messrs. Babcock & Wilcox, Ltd., at £132, for steam piping.

London.—BATTERSEA.—The Metropolitan Water Board has accepted the tender of Messrs. C. A. Parsons & Co., Ltd., at £3,634, for a high-speed turbine and a slow speed Gwynne pump to the Battersea pumping station.

In view of the present condition of trade, and the uncertainty as to future prices, the Works Committee of the Metropolitan Water Board has been considering the question as to whether the usual practice of inviting tenders for periodical contracts for stores, &c., should be adhered to, and has formed the opinion that it might be to the advantage of the Board to arrange for an extension of as many of the existing periodical contracts as possible. In accordance with this proposal the Committee has recommended the Board to extend for a further period of six months their contracts with the Maxim Lamp Works, Ltd., for the supply of lamps with wire drawn filaments in one continuous length, and the B.I. & Helsby Cables, Ltd., for tapes. The Board has accepted the tender of the St. Helens Cable and Rubber Co., Ltd., at £44, for a supply of copper cable required for portable electric lighting plant.

Nuneaton.—The T.C. has accepted the tender of Messrs. Callender's Cable Co., Ltd., for cables, for a period not exceeding four years, on the basis of copper at £52 10s. per ton, and lead at market price at the time of ordering.

Sunderland.—The T.C. has accepted the following tenders :—

Recording voltmeters.—Everett, Edgcumbe Co., Ltd.
Coal chutes.—J. W. Thompson & Co.
Control panel for feeder boos er.—Phœnix Dynamo Mfg. Co., Ltd.
Underfeed stoker.—Underfeed Stoker Co.

Swansea.—The tender of the British Thomson-Houston Co., Ltd., is recommended to the Town Council for acceptance at £37 for the overhauling of the turbo-alternators and condensing plant at the electricity station.

Walsall.—The Tramways Committee has accepted the following tenders for annual supplies :—

Brake blocks.—National Rail and Tramways Appliances Co., Ltd.
Tantalum lamps.—Siemens Bros. & Co., Ltd.
Pinion wheels.—Alfred Wiseman, Ltd.
Strand wire.—S. Peace & Son, Ltd.
Mechanical ears.—B.I. & Helsby Cables, Ltd.
Trolley wheels.—Anti-Attrition Metal Co., Ltd.
Pitch and creosote oil.—Brownhills Chemical Works, Ltd.
Point rubbers.—Dermatine, Ltd.
Varnish.—Docker Bros., Ltd.
Controller fingers.—Dver & Young.
Best solder, emery cloth and sandpaper.—J. Gilbert & Son.
Linen frame tape and linen tape.—J. North Hardy & Son.
Paragon tape and Acme tape.—British Thomson-Houston Co., Ltd.
Malleable-iron castings.—H. W. Lindop.
Armature coils.—P. R. Jackson & Co., Ltd.
Poplar wood blocks.—E. W. Turner & Co., Ltd.
Oak floor lathing.—Brookes & Croton.
Bearing metal.—Glacier Anti-Friction Metal Co., Ltd.
Carbon brushes.—Heap & Johnson.
Metal polish.—Matchless Metal Polish Co., Ltd.
Air-drying Voltalac.—Pinchin, Johnson & Co., Ltd.
Motor grease and lubricating oil.—Vacuum Oil Co., Ltd.
Linseed oil.—H. D. Hayward.

The Electricity Committee has accepted the following tenders :—

E.H.T. cables.—Callender's Cable Co., Ltd., £9,537.
Sub-station switchgear.—British Westinghouse Co., £3,267.
Rotary convertors.—Siemens Bros., £5,240.

Wolverhampton.—The City Council has been recommended to accept the tender of the Pulsometer Engineering Co., Ltd., at £137, for a 5-in. centrifugal pump, and 12½-B.H.P. three-phase enclosed ventilated motor and one motor panel. The Tramways Committee has accepted the following tenders :—

Copper cable.—Callender's, Ltd., £1,310.
Negative booster.—Rees Roturbo Manufacturing Co., Ltd., £235.
Four Albion 25-H.P. chassis.—Wells & Mayner.

FORTHCOMING EVENTS.

North-East Coast Institution of Engineers and Shipbuilders.—Friday, December 18th. At 7.30 p.m. At Bolbec Hall, Newcastle-upon-Tyne. General meeting.

Wireless Society of London.—Friday, December 18th. At 8 p.m. At Institution of Electrical Engineers, Victoria Embankment. Lecture on "The High-Frequency Resistance of Wires and Coils," by Prof. G. W. Osborn Howe, D.Sc.

Physical Society of London.—Friday, December 18th. At 8 p.m. Various experiments, including (No. 10) The Comparison of nearly equal Electrical Resistances, by Dr. G. F. C. Searle, F.R.S.

Association of Mining Electrical Engineers.—Saturday, December 19th. At 4.30 p.m. At Royal Technical College, Glasgow. Paper on "Experiences of Surface Earthing in Scottish Mines," by Mr. P. S. Glover.

Institution of Post Office Electrical Engineers.—Monday, December 21st. At 6 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Paper on "Power Circuit Interference with Telegraphs and Telephones," by Mr. S. C. Bartholomew.

Greenock Electrical Society.—Thursday, December 24th. At 21, West Stewart Street. At 7.45 p.m. Social Meeting.

NOTES.

Christmas Holidays.—Owing to the Christmas holidays and the consequent closing of the ELECTRICAL REVIEW offices on Friday and Saturday, December 25th and 26th, our issue for the next week will appear on Wednesday morning, December 23rd. Will readers, contributors and advertisers kindly take note of the following times for sending in matter, &c. :—

Editorial: All communications for the Editorial department, except the latest items of special news, should be sent in so that we receive them by Monday morning, December 21st.

Advertisements: The Advertisement department announces elsewhere in to-day's pages that all new advertisement copy and alterations to existing displayed advertisements should reach 4, Ludgate Hill, E.C., not later than Friday morning, 18th inst. "Official Notices" and small prepaid advertisements can be received up to 9.30 a.m. on Tuesday, the 22nd inst.

Censorship of Cable Telegrams.—While we are averse to occupying space with trifles, we cannot refrain from a further reference to the recent belated attack upon us which appeared in the columns of the *Electrician*. Although we stated, in our issue of December 4th, that we did not think it necessary to justify our course with regard to the Commercial Cable Co.'s actions in the eyes of our contemporary, the latter last week reprinted the concluding paragraph of our leaderette—prudently omitting the preceding paragraph—and professed to see in it an implied criticism of the company's action. We reproduce the paragraphs in question below :—

"We may add that we do not object to criticism, provided that it is sincere; but we do not accept as such that of our contemporary in this instance.

"The relations of that journal to the telegraph companies are well known. We may point out that our leaderette was published on October 16th; 14 days afterwards we received a letter from the London manager of the company, which we published on November 6th, together with a note in reply, repeating our protest. The attack upon us in the *Electrician* appeared on November 27th—after an interval of three weeks.

"The head office of the company is in New York, whence all important transactions are directed. The conclusion is obvious."

We repeat that the conclusion *is* obvious—even to the meanest intelligence—and to profess doubt as to our meaning is too transparent a subterfuge to mislead anyone. For the benefit of our artless contemporary, however, we may recall, with suitable modification, the explanation of the telegraph given to an Oriental potentate :—The telegraph is like a dog with its tail in New York and its head in London; if you pinch its tail in New York, the dog barks in London. *Hinc illæ lachrymæ.*

Fire at Edison Plant in U.S.A.—We are informed that the fire reported in our issue of last week affected only the phonograph departments. We are glad to say that the remainder of the buildings and machinery are intact, including those devoted to the Edison Storage Battery, which are working to their full capacity of 3,000 cells per day.

Appointments Vacant.—Jointer (£2), switchboard attendant (25s.), mains assistant (£91), for Wishaw electricity department; foreman of railway telegraphs (£250+), for Ceylon Government Railway; storekeeper (30s.), for Burnley Corporation electricity works. Particulars are given in our advertisement pages.

The Electric Vehicle.—The first number of the *Electric Vehicle*, the new quarterly publication of the Electric Vehicle Committee of the I.M.E.A., was issued last week, and does credit to its producers. It consists of about a dozen pages of reading matter and as many of advertisements, together with a one-page supplement designed to demonstrate the inherent simplicity of the electric motor in contrast with the complexity of the petrol engine and gear box, and a sample set of "mail cards" issued by the Committee.

Pride of place is given to the electric commercial vehicle, which, as we have urged for some years, is the type with which the campaign must be opened. Other articles deal with the good qualities of the electric vehicle, the electric omnibuses at South Shields, vehicles in London, &c. The work of the Electric Vehicle Committee is outlined, and particulars are given of the plugs, &c., that have been standardised; and a list is given of 43 users of electrics, including, we are pleased to see, 15 municipalities, the G.P.O., and two railway companies. The total number of vehicles in the list, in use or on order in this country, is exactly 100; we hope a twelvemonth will put another cipher on this number. Corporations and others have contributed £185 in support of the Committee's work. The journal will in future be edited by Mr. A. Hugh Seabrook.

Fatalities.—Portsmouth.—An inquest was held last week into the death of Frederick W. Hepworth, aged 31, a charge engineer at the Portsmouth electricity works, which occurred on 7th inst. Mr. Benjamin Handley, electrical engineer, said that he was summoned to the station at 7 a.m. on the morning in question and found deceased lying on the rectifying platform, near the switchboard, quite dead. He had been seen a little before in the act of putting in the plugs of the flexible leads on the platform. He was seen to fall, artificial respiration was tried, and a doctor was sent for.

In reply to the Coroner, Mr. Handley said the current that had passed through the deceased's body was at 3,000 volts. The palms and fingers of the deceased's right hand were badly burned. According to the report in the *Hampshire Telegraph*, Dr. Lysander Maybury advanced the opinion that the deceased committed suicide. The burns on the fingers showed that the deceased must have caught hold of the live end of one of the flexible leads. There were pieces of skin on the live end of the lead to show where it had been held. Had he held the insulated ends it would have been impossible for him to receive a shock. As a possible reason for the deceased taking his own life, Dr. Maybury said there were indications that he must have fancied that he was suffering from a disorder of which, however, the post-mortem examination showed no trace. Recalled, Mr. Handley said electrical engineers, from mere force of habit, always picked up the leads by the insulated ends. They never touched the live ends. He did not think it possible that the deceased could have picked up the live ends even accidentally. In summing up, the Coroner said it was unthinkable that an expert like the deceased should have even accidentally picked up the live ends of the leads. As against the suicide theory, however, he pointed out that the deceased was of a cheerful disposition, and that he had no trouble. The jury found that the deceased died from the effects of an electric shock, but they considered the evidence insufficient to show how the shock was brought about.

Institution and Lecture Notes.—Institution of Electrical Engineers.—At the meeting last week the President reminded the members of the loss of H.M.S. *Bulwark*, and stated that the commander, Captain Guy L. Sclater, R.N., was a member of the Institution, and had perished in the service of his country, at the post of duty. He therefore called upon them to express their respect for the late member and their sympathy with his relatives by standing in silence, and this was done.

At the meeting of the Manchester Local Section on Tuesday last, the paper by Mr. E. B Wedmore on "Automatic Protective Switchgear for A.C. Systems" was read and discussed.

At the meeting of the Birmingham Local Section on Wednesday, the same paper was read and discussed. The President, Sir John Snell, and the Secretary, Mr. P. F. Rowell, were present at the meeting.

Faraday Society.—The annual general meeting was held on November 23rd. The following officers were elected to serve for the year 1914-15:—President, Sir Robert Hadfield, F.R.S.; treasurer, F. Mollwo Perkin, Ph.D.

Royal Institution of Great Britain.—The following arrangements are announced for the Friday evening meetings before Easter, 1915:—

January 22nd.—Prof. Sir James Dewar, F.R.S., &c., on "Problems of Hydrogen and the Rare Gases."
January 29th.—Dugald Clerk, D.Sc., F.R.S., &c., on "Gaseous Explosions."
February 5th.—Prof. A. W. Crossley, F.R.S., &c., on "Science and Industrial Problems" (Experimentally Illustrated).
February 12th.—William S. Bruce, LL.D., &c., "Recent Advances in Oceanography."
March 26th.—Prof. Sir J. J. Thomson, O.M., F.R.S., &c., "Experiments in Slow Cathode Rays."

The afternoon lecture arrangements include the following:—

"Aerial Navigation, Scientific Principles": (1) The Requirements of Theory; (2) The Requirements of Practice, by Richard T. Glazebrook, C.B., F.R.S., &c. Two lectures on Saturdays, January 23rd, 30th.
"Recent Researches on Atoms and Ions," by Prof. Sir J. J. Thomson, O.M., F.R.S., &c. Six lectures on Saturdays, February 20th, 27th, March 6th, 13th, 20th, 27th.

Mr. E. P. Hollis, of Birmingham, gave an address on the electric drive to the members of the Wolverhampton Engineering Society, on Friday last. As showing the economies brought about by electric drive, Mr. Hollis mentioned an instance where coal formerly cost £5 per week at a certain saw mill, in addition to which the sawdust accumulated was burnt under the boiler. After electrification the cost of energy was £5, but, on the other hand, the sawdust was sold, and realised £6 per week.

Mr. R. Stuart Pilcher, general manager of the Aberdeen Corporation Tramways, recently lectured on "Some Impressions of Tramways at Home and Abroad." He referred to the question of private *versus* municipal ownership and favoured the municipally-owned system.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—With a view to retaining the services of Mr. Glen, mains superintendent at the Tynemouth electricity works (who has had an offer of a more remunerative position), the Corporation has been recommended to increase his salary to £3 10s. per week, as from April 1st next.

Mr. T. R. McCandlish, draughtsman and clerk of works to the Coventry Corporation tramways department, has resigned, having accepted a similar position in the Coventry Corporation electricity department.

Mr. P. T. Forth, who has for the past five years had charge of the Priestman power station at Blaydon Burn, has been appointed resident engineer at the Bank Foot and Bowden Close power stations, Crook, and on leaving he was presented by the officials and staff with an umbrella, a case of pipes and a tobacco pouch.

General.—Alderman C. Johnson has been appointed chairman of the Hammersmith B.C. Electricity Committee, and Councillor G. T. H. Stamper, vice-chairman.

Mr. C. F. de Nordwall has resigned from the boards of the following English companies of the A.E.G.:—The A.E.G. Electrical Co. of South Africa, Ltd. (managing), A.E.G. Electric Co., Ltd., the Electrical Co., Ltd., the British N.A.G. Motor Co., Ltd. (managing), thereby entirely severing his connection with the German electrical industry. Mr. C. F. de Nordwall, who has been a naturalised British subject since 1890, has joined Messrs. Vickers, Ltd., to direct the commercial side of their electrical department.

Wills.—The late Mr. J. M. Augustus Stroh left estate of the value of £93,901. His bequests included £500 to the Institution of Electrical Engineers—£250 to the Building Fund and £250 to the Benevolent Fund.

NEW COMPANIES REGISTERED.

Rex Accumulator Co. Ltd. (138,529).—This company was registered on Dec. 5th, with a capital of £24,000 in £1 shares, to take over the British patent for an invention relating to the manufacture of electric accumulator plates, and all rights relating thereto in all British colonies, dependencies, provinces, dominions and states (except Canada), subject to, but with the benefit of, the licenses therefor granted to the Electrical Power Storage Co., Ltd., by an indenture dated July 25th, 1913, and to adopt an agreement with the last-named company. The subscribers (with one share each) are: D. Willock, 9, New Broad Street, E.C., company secretary; M. Leggett, 4, Great Winchester Street, E.C., company secretary. Private company. The number of directors is not to be less than three or more than six; the first are Sir James Pender, Bart., J. Gray, D. Willock, and a person to be nominated by Gaszynski Brothers & Co., who are, while holding 4,000 shares, to be entitled to nominate one out of every three of the directors. Qualification, £200. Registered office: 4, Great Winchester Street, E.C.

Hodgson Pump Co., Ltd. (138,581).—This company was registered on Dec. 10th, with a capital of £20,000 in £1 shares, to take over certain patents relating to the Sunturbo Pump granted to F. K. Woodroffe and H. C. Hodgson, to adopt an agreement between the said F. K. Woodroffe and H. C. Hodgson of the first part, E. R. Royston of the second part, G. W. Grimshaw of the third part, E. Long of the fourth part, A. G. Inglis and E. C. Edgecombe of the fifth part, the said G. W. Grimshaw, F. K. Woodroffe and H. W. Boultbee of the sixth part, and the company of the seventh part, and to carry on the business of electrical and general engineers, manufacturers of pumps and mechanical and engineering devices and contrivances in connection with pumps and pumping machinery, manufacturers of pneumatic, power and steam hammers, forging machinery and plant, mine and mining machinery and accessories. The subscribers (with one share each) are: G. W. Grimshaw, Bamber Bridge, near Preston, managing director; W. Norris, Bamber Bridge, near Preston, engineer; F. K. Woodroffe, 32, Clarendon Road, Egremont, consulting engineer; H. C. Hodgson, Bamber Bridge, near Preston; J. Fearon, 35, Dale Street, Liverpool, clerk; N. Mason, 35, Dale Street, Liverpool, articled clerk; E. C. Edgecombe, 35, Dale Street, Liverpool, solicitor. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than nine) are: G. W. Grimshaw, W. Norris, F. K. Woodroffe and H. C. Hodgson. Qualification, £100. Remuneration (except managing director) as fixed by the company. Solicitor, A. G. Inglis, 35, Dale Street, Liverpool.

Maud and Turner, Ltd. (138,596).—This company was registered on Dec. 11th, with a capital of £12,000 in £1 shares, to take over (1) freehold works, land and premises known as Perseverance Works, at Gibbet Street, Halifax, and the business carried on thereat, and (b) the plant and machinery models and goodwill of the said business, to adopt an agreement between Harriett Maude and E. Booth of the one part, and J. Evison of the other part, to carry on the business of tool makers, founders, mechanical and electric engineers, manufacturers of dynamos, motors, motor carriages and vehicles, etc. The subscribers (with one share each) are: G. Stirk, 23, Lentil Field Street, Halifax, engineers' tool maker; E. Stirk, 36, Elmfield Terrace, Halifax, engineers' tool maker; R. Stirk, 6, Turney Street, Halifax, engineers' tool maker; J. G. Stirk, 25, Lentil Field Street, Halifax, engineers' tool maker. Private company. The number of directors is not to be less than two; the first are G. Stirk, E. Stirk, R. Stirk and J. G. Stirk. Qualification, £100. Registered office: Perseverance Works, Gibbet Street, Halifax.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

North-Eastern Electric Smelting Co., Ltd.—Particulars of £4,500 first mortgage debs., created 13th November, 1914, filed pursuant to Section 93 (3) of the Companies (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

Edison and Swan United Electric Light Co., Ltd.—Capital £88,071 in 150,000 "A" and 26,436 "B" shares of £5 each, and 23,564 "B" shares of 5s. each. Return dated Nov. 30th, 1914. 116,400 "A" and 23,564 "B" shares taken up. Ten shillings per share called up on 89,261 "A"; £44,630 10s. paid; £344,738 considered as paid, being £5 per share on 17,139 "A," 5s. per share on 23,564 "B," £2 10s. per share on the above 89,261 "A," and £3 per share on 10,000 "A" shares. Mortgages and charges, £449,474.

Lithanode, Ltd.—Capital, £3,000 in £1 shares. Return dated Nov. 30th, 1914. 3,000 shares taken up, of which 225 have been forfeited. £1 per share called up on 2,275 shares; £2,340 paid, including £65 paid on 225 forfeited shares; £500 considered as paid. Mortgages and charges, £1,700.

Oliver Arc Lamp, Ltd.—Capital, £2,000 in £1 shares. Return dated Oct. 28th, 1914. 1,407 shares taken up. £7 paid; £1,400 considered as paid. Mortgages and charges, £15,000.

Pacific and European Telegraph Co., Ltd. (36,863c).—Capital, £100,000 in £10 shares. Return dated Nov. 24th, 1914. All shares taken up. £4 per share called up; £40,000 paid. Mortgages and charges, £68,400.

Western Telegraph Co., Ltd. (6,886c). — Capital, £2,500,000 in £10 shares. Return dated Nov. 25th, 1914. 207,930 shares taken up. £10 per share called up on 130,000 shares; £1,300,000 paid; £779,300 considered as paid on 77,930 shares. Mortgages and charges, £818,675.

CITY NOTES.

British Columbia Electric Railway Co., Ltd.

The directors express regret that the report for the year to June 30th, 1914, is not of so satisfactory a character as in the past, and that, in order to maintain the usual dividends, it will be necessary to supplement the profits by a transfer of £10,000 from the reserve. They recommend this course with some hesitation, in view of the extremely unfavourable outlook for the current year caused by the war, but they desire to avoid throwing any additional hardship upon the stockholders at this time, and for that reason propose to draw upon the reserve. At the last annual general meeting it was pointed out that the earnings for the year, now under review, were being adversely affected by the conditions then prevailing. The depression in trade in Canada, to which reference was then made, unfortunately became accentuated as the year advanced, and rigid economy has been necessary to achieve the results shown by the accounts. Further economies are still being effected wherever it is possible to put them into force. The following charges have been made against the revenue account for the year:—Provision for renewals maintenance £149,921, added to capital amortization £2,455. The net profit amounts to £393,956, plus £9,519 brought forward and £10,000 transferred from reserve, making £413,475. Deduct interest on debentures and debenture stock to June 30th, 1914, £132,990, dividends already paid on 5 per cent. cum. perp. pref. stock for the year to June 30th, 1914, £72,000; on preferred ordinary stock for the year to June 30th, 1914, £86,400; on deferred ordinary stock for the six months to December 31st, 1913, £57,600; leaving available for further distribution £64,484, from which a dividend on the deferred ordinary stock at the rate of 8 per cent. per annum for the six months ended June 30th, 1914, is to be paid, making 8 per cent for the year, leaving to carry forward £6,884. Owing to the depression, the large employers of labour in British Columbia have been temporarily forced to postpone all new work, and as a result it is reported that there has been a decrease in the population of Vancouver and the neighbouring districts of approximately 20,000 inhabitants; and there has consequently been a decrease of over 8,500,000 in the number of passengers carried during the year. The financial effect of this decrease in passengers would have been even more marked but for the small advance in fares put into force in September, 1913. The directors anticipated some improvement during the latter half of the present year, but these hopes were extinguished on the outbreak of war. All companies operating in a new country have at times to face periods of severe reaction in the development of their business. As a result of the war commercial conditions in British Columbia could not well be worse than they are at present, and the revival in trade may be greatly retarded. Stockholders must consequently be prepared for a drastic reduction in future dividends, but the directors believe that the halt in the development of the Province will, in the end, result in more stable conditions.

During the past year the expenditure on capital account has been reduced to a minimum. A public utility company must continuously incur certain capital outlay to comply with its franchise obligations, but the policy of limiting expenditure to absolute necessities will be rigidly followed until the return of more prosperous times.

In reviewing the work which has been accomplished, the chief engineer reports that the company's plant is in a satisfactory state of efficiency, and that the company is in an excellent position to profit by the improvement in the business conditions of British Columbia when it takes place.

It is with the greatest regret that the directors announce that Mr. Buntzen, who retires at the annual general meeting, has decided not to seek re-election, owing to his continued residence in Denmark. Mr. Buntzen has, however, consented to accept the position of adviser to the directors, and they intend to appoint him. The benefit of his invaluable advice and experience will thus be available to the company. During the first eight years of the company's existence Mr. Buntzen was general manager in British Columbia, and the company owes him a debt of gratitude for his many years of close devotion to its affairs and for the benefits secured by his clear judgment and foresight.

In order to be kept in the closest touch with the conditions prevailing in British Columbia and with the details of the company's business, the board has appointed Mr. R. H. Sperling (who has for the past nine years held the position of general manager in British Columbia) as assistant to the chairman, and has elected him a director in succession to Mr. Buntzen.

The board has appointed Mr. George Kidd to succeed Mr. Sperling as general manager. Mr. Kidd was formerly secretary and recently controller to the company. The board are confident that they have secured a very capable successor to Mr. Sperling.

The directors again have pleasure in expressing their appreciation of the loyal and satisfactory services rendered by the management and staff in British Columbia.

The directors recognise that the immediate future must be a period of adversity, during which a large reduction of dividend will be necessary, but they see no reason to lose confidence in the future of the company's undertaking.

The meeting is to be held to-day (Friday) at Liverpool Street Hotel, E.C.

Year ended June 30th.	Income after charging renewals maintenance.	No. of passengers.	No. of lamps in use.	Balance available for dividend.	Rate of div. paid per annum. Pref. ord. s ock.	Def. ord. stock.	Amount taken to reserves.
1913 ..	£385,846	62,154,166	735,426	£257,670	6 %	8 %	£197,391
1913 ..	401,836	71,974,822	920,916	258,244	6 %	8 %	196,911
1914 ..	413,229	63,429,023	991,623	260,956	6 %	8 %	154,920

Metalite, Ltd.

An extraordinary general meeting of the company was held on Tuesday at the Institute of Chartered Accountants, Moorgate Street, Mr. E. C. Vincent presiding.

The Chairman said the meeting was purely for the purpose of passing a resolution to sanction the new reconstruction agreement which had been necessitated by the satisfactory completion of the negotiations which had been carried out by the liquidator during the past month. The main alterations were that the parties to the first mortgage were now Messrs. Arkwright & Saunt, in place of the London City and Midland Bank; while the debenture holders were now taking shares instead of cash. The new prospectus had been duly filed and signed by the new directors. The liquidator's letter of 5th December issued to the shareholders, fully set out the reasons for the meeting, and dealt with the alterations in the agreement. He might say that he had received numerous letters from shareholders asking for information on various points and, as far as possible, he had supplied it.

A shareholder asked whether, supposing the present shareholders did not exercise their option in regard to taking up shares in the new company, they would lose all.

The Chairman said that any shareholder who did not exercise his right to apply for the new shares became a dissentient under the Act, and he was entitled to have the value of his shares assessed by an arbitrator. He might remind them that, in accordance with the reconstruction agreement, if there were dissentients representing more than 2,000 shares the new company need not carry out its bargain, and it would not do so. There could be no doubt that had it not been for the new company coming forward the original shareholders would have lost every penny of their money, as would also the debenture holders. What it came to was that those shareholders who did not exercise their rights under the agreement were not likely to receive anything. The alteration in the agreement was very favourable to the new company, because instead of having to find cash to the extent of £11,000, those mortgages were now taken in shares. The new company was under the control of men who thoroughly understood the business. One of the directors was connected with one of the biggest wire filament manufacturing businesses outside the ring, and that inspired the debenture holders with sufficient confidence that they were prepared to take shares in respect of their mortgages. If the scheme was carried, the shareholders would have to provide 6d. per share within a certain time, but he thought it might be left to the directors to deal as leniently as possible with any shareholders who might want an extension of time for paying their calls.

Mr. Walton Lee then moved the following resolution:—

"That the agreement submitted to this meeting dated the 3rd day of December, 1914, and expressed to be made between this company and its liquidator on the first part, W. H. Gatty Saunt and W. L. T. Arkwright of the second part, Herbert Samuel Golding and James McDougall of the third part, William Plato Oulton of the fourth part, R. C. J. Goodrich of the fifth part, Herbert Samuel Golding of the sixth part, Bryant Trading Syndicate, Ltd., of the seventh part, International Filaments, Ltd., of the eighth part, and Derby Lamp Works, Ltd., of the ninth part, be and the same is hereby sanctioned and the said liquidator be and he is hereby authorised pursuant to section 192 of the Companies (Consolidation) Act, 1908, to carry the same into effect."

He remarked that he ought to mention that he had some interest in the new company. He did not wish to disclose any trade secrets, but it was common knowledge that since the outbreak of the war this country was now in the position of having a monopoly in the electric lamp trade. Previously, much of the trade was in German hands. He was not going to prophesy that the new company would make enormous profits and pay large dividends, but it would interest them to know that the new directors were backing up their opinions by their money, and they would not do that unless they thought the thing was going to be a success. The management was the keystone of the whole position. The directors

were getting the very best men to manage the new company and, talking to one of the directors recently, he said he was of opinion that within a short time the shares in the new company would be worth £1. He hoped the shareholders would exercise their option and take up the shares to which they were entitled.

Mr. WILLIAM STEWART, in seconding the motion, said that notwithstanding the difficulties through which the company had passed he hoped the shareholders would rally round the new board and make the Derby Lamp Works the most powerful and progressive lamp works in the country. There was no reason why that should not be done. They had men of unimpeachable qualifications on the board who possessed a technical and practical knowledge of the trade—an experience which none of the directors in the old company possessed.

Mr. HOUSTON, in supporting the resolution, said he thought the shareholders of Metalite would be very foolish if they did not take advantage of what was almost a gift. The conditions now prevailing owing to the war were all to their advantage, and the present scheme was evidently a genuine effort to save something out of the wreck.

The CHAIRMAN, in reply to questions, said that the old company had a special lamp—the Boran—which was in the experimental stage. That lamp had, however, been quite superseded in so far as efficiency was concerned by the ordinary drawn-wire lamp. It was now intended to manufacture lamps from drawn wire, the materials for which were to be supplied from one of the largest firms outside the ring. The new company would compete in the open market with other manufacturers, and the board had come to the conclusion that that could only be done successfully by producing a lamp at a cheaper price than that now ruling with the Tungsten Lamp Association. The new works manager was Mr. J. L. Green, who had come from the Osram Works, at Hammersmith. They were obliged to go to the enemy's camp in order to get the right men. The position with regard to the works at Derby was that there was a certain quantity of obsolete machinery which would be disposed of, and a certain amount of small machinery for bending wire would be purchased. It did not look as if the new company would have to spend much money on new machinery, because they would receive a certain sum for old plant. The new manager was of opinion that the factory was capable of turning out three million lamps per annum, but they were working on the basis of one million for the first year. He might say that he had received proxies representing 46,700 shares in favour of the agreement and none against.

The resolution was then carried.

Mr. LEE proposed a vote of thanks to the Chairman, which was seconded by Mr. ROSENTHAL, who remarked that the shareholders were deeply indebted to Mr. Vincent for the way in which he had worked to pull the company out of the mire and put it on a firm basis.

The resolution was carried, and briefly acknowledged by the CHAIRMAN.

Melbourne Electric Supply Co., Ltd.

THE directors' report for the year ended 31st August, 1914, states that in January last they offered for subscription at 97½ per cent. a further £150,000 five per cent. consolidated debenture stock, the whole of which was applied for and allotted.

To provide for future expansion a resolution will be submitted at the meeting on Monday next for the increase of the capital of the company by £300,000, divided into 20,000 seven per cent. first cumulative preference shares of £5 each to rank equally with the existing preference shares, and 200,000 ordinary shares of £1 each, the latter to be converted, when fully paid, into £200,000 consolidated ordinary stock to rank equally with the existing ordinary stock. It is proposed to issue on February 1st next 75,000 ordinary shares of £1 each at par, to be converted, when fully paid, into £75,000 consolidated ordinary stock, and to be allotted as nearly as possible *pro rata* (*i.e.*, 1 in 4) to the holders of the existing £300,000 consolidated ordinary stock whose names appear on the register at the close of business on the 23rd January prox. The directors also propose to issue, as and when required, a further £25,000 five per cent. consolidated debenture stock. It is estimated that the proceeds of these issues will suffice for the capital requirements of the company at Melbourne and Geelong for the next twelve months.

£5,000 has been applied during the year in writing off certain items in the Melbourne plant account; and the capital accounts at Melbourne and Geelong now stand as follows:—

	Expenditure to Aug., 1913.	Expenditure during the year.	Total written off to Aug., 1914.	Balance of expenditure at Aug. 31, 1914.
Melbourne	£693,553	£166,482	£11,512	£848,523
Geelong .. .. (including trams)	147,071	18,963	3,775	162,259
	£840,624	£185,445	£15,287	£1,010,782

The area of the suburban districts in Melbourne covered by the company's statutory powers is approximately 74 square miles; and a supply is now available in 482 miles of streets, being an increase of 72 miles during the year. 5,495 new consumers were connected to the mains during the year, bringing up the total number connected to 19,066, being an increase of 40 per cent. as compared with the previous year. The power supply has increased by 30 per cent., the electric motors now connected being equivalent to 12,444 H.P.; the total connections, including lamps, motors, heating, and other apparatus, have increased by 32 per cent.; the total units sold by 43 per cent.; and the gross revenue by 30 per cent.

The profit and loss account shows that the gross revenue for derived during the year from the Melbourne and Geelong undertakings amounted to £104,040, as compared with £77,092 for the previous year, an increase of 35 per cent. After payment of debenture interest, and management and general expenses at the London head office, and after making the following allocations, viz.:—

To first debenture stock sinking fund £2,500, consolidated debenture stock sinking fund £2,609, income certificate service fund £1,800, general reserve (raising the latter to £65,000) £5,000, suspense account, to meet the cost of writing off sundry items of plant at Melbourne and Geelong £5,000, writing off the balance of cost of issues of consolidated debenture stock in 1913 and 1914 £10,561, dividend equalisation account £10,000, writing down head office furniture £50,

there remains a credit balance of £43,804, plus £4,516 brought forward, making a total credit balance of £48,320. After paying the seven per cent. pref. dividend for the year and 10 per cent. on the cons. ordinary stock, £7,820 remains to be carried forward.

Date	Consumers.	Lighting in KW.	Motors in rated H.P.	Total connections in KW.	Total units sold.	Gross profit.
Melbourne—						
Aug. 31, 1912	8,696	8,232	7,453 H.P.	15,735	7,082,871	£50,281
Aug. 31, 1913	13,671	12,139	9,581 H.P.	21,720	9,740,194	£68,581
Aug. 31, 1914	19,066	16,113	12,444 H.P.	29,759	13,963,800	£93,202
Geelong— (including trams)						
Aug. 31, 1912	1,099	1,453	1,380 H.P.	2,833	753,611	£5,990
Aug. 31, 1913	1,456	1,734	1,845 H.P.	3,580	1,034,052	£8,511
Aug. 31, 1914	1,839	2,050	2,085 H.P.	4,133	1,275,280	£11,137

Mr. F. W. Clements, the company's local managing director and chief engineer, came home on leave during the year, and the directors had the advantage of personally conferring with him in regard to the position and prospects of the company in Australia.

Adelaide Electric Supply Co., Ltd.

THE directors, in their report for the year ended 31st August, 1914, state that the capital account now stands as follows:—Total expenditure to 31st August, 1913, £607,387, plus further expenditure during the past year £143,036, less amounts written off £12,074, making £738,349.

The capital necessary to keep pace with the continued growth of the company's business has been provided for by the following issues:—10,000 ordinary shares issued in July, 1913, at a premium of £3 per share, and fully paid during the past financial year; 9,635 preference shares issued in March last at a premium of 5s. per share; £25,000 five per cent. debenture stock.

The area of the districts covered by the company's powers is 155 square miles; and a supply is now available in 361 miles of streets, an increase of 59 miles during the year. 2,932 new consumers were connected to the mains, bringing up the total number connected to 13,192, an increase of 16 per cent. as compared with the previous year. The power supply has increased by 17 per cent., the electric motors now connected being equivalent to 7,347 H.P.; while the total connections, including lamps, motors, heating, and other apparatus, have increased by 24 per cent.; the total units sold by 24 per cent.; and the gross revenue by 25 per cent.

The profit and loss account shows that the gross profits for the year amounted to £111,986, as compared with £89,591 for the previous year, being an increase of 25 per cent. After payment of debenture interest, and management and general expenses in London and Adelaide, and after allocating £5,360 to debenture stock sinking fund, there remains a credit balance of £40,492, plus £9,865 brought forward, making a total credit balance of £50,357. Deducting the preference dividend for the half-year ended 28th February, 1914, and the interim ordinary dividend of 5 per cent., free of income tax, paid on 1st June, 1914, there remains an available balance of £33,357. The directors recommend the dividend on six per cent. preference shares for the half-year ended 31st August, 1914 (paid on 1st September, 1914), £5,042; final dividend of 5 per cent., free of income tax, on ordinary shares, making 10 per cent. for the year, £12,500; to bonus of 2 per cent., free of income tax, on ordinary shares, £5,000; leaving to be carried forward £10,815.

Date.	Consumers.	Lighting in KW.	Motors in rated H.P.	Total connections in KW.	Total units sold.
Aug. 31, 1912	7,863	5,724	5,197 H.P.	10,861	4,516,398
Aug. 31, 1913	11,351	7,752	6,270 H.P.	14,022	5,416,488
Aug. 31, 1914	13,192	10,107	7,347 H.P.	17,453	6,740,991

Mr. F. W. Clements, a member of the local board in Adelaide, came home on leave during the year, and the directors had the advantage of personally conferring with him in regard to the progress of the company's business.

The meeting is called for Tuesday next, in London.

India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.

THE directors report that for the year ended September 30th, 1914, the accounts show, after provision for doubtful debts, a net loss of £18,922. Transferring £50,000 from the reserve fund, adding £7,455 brought forward, deducting £12,500, the dividend on the preference shares paid in January and July and accrued to 30th September, and £12,500, the interim dividend on the ordinary shares paid in July, there remains a disposable balance of £13,534, which, after providing for the proposed dividend on the ordinary shares, will leave £1,034 to carry forward. The directors recommend that the payment of the half-yearly dividend of 5s. per share, or at the rate of 5 per cent. per annum, be made to the preference shareholders and that a dividend of 5s. per share, free of income tax, amounting to £12,500, making with the interim dividend paid in July a total of 5 per cent. for the year, be paid to the holders of ordinary shares; both these dividends to be payable on the 1st January prox. The directors much regret to have to make such a disappointing statement. The loss is due to a number of causes. The war caused a diminution of sales in England and the entire stoppage of manufacturing in France. The German army went within a couple of miles of Persan, and the works had to be closed and abandoned. But the most serious losses incurred have not been due to the war. The

loss due to faulty organisation at the French factory, previously reported, fell on this year to a considerable extent, though that organisation has, the directors believe, now been put on a thoroughly sound basis. Then their foreign agencies have incurred a serious loss, partly through bad trade in Australia, South America, Africa and Japan, and partly through certain unprofitable contracts. As the main causes of the company's trouble are believed to be at an end, and the works at Persan have been re-opened, the directors recommend to the shareholders the bold policy of taking £50,000 from the reserve and paying a dividend of 2½ per cent., making 5 per cent. on the ordinary shares. The directors regret to report the complete loss on the coast of Madagascar of the ss. *Buccaneer* while employed by the French Government on cable repairs. The ship was fully insured and the insurance has been paid. The ss. *Dacia* has been employed for a portion of the year, but the amount of submarine cable manufactured has been small. The works and machinery at Silvertown have been efficiently maintained. Mr. G. W. Smith, the company's late manager at Persan, has been appointed an extraordinary director.

The meeting will be held at 106, Cannon Street, E.C., on December 22nd.

Prospectus.—*Derby Lamp Works, Ltd.* — Fortune assuredly smiles at last upon the shareholders of Metalite, Ltd. Readers of the ELECTRICAL REVIEW do not need to be reminded of the unfortunate history of this concern, but those who have followed its proceedings from the early demonstration at Highbury, when the most brilliant prospects were reported both for the lamp and for the shareholders, to the closing of the Derby Lamp Works, will, we are sure, be interested to know that a prospectus now lies before us of the Derby Lamp Works, Ltd. It gives Metalite shareholders an opportunity to take their courage in both hands, and when they have done that to put one of the said hands in their pocket. In other words, they alone are entitled to 187,081 ordinary shares of 5s. each, issued as paid up to the extent of 3s. 6d. in Derby Lamp Works, Ltd.; that is, with a liability of 1s. 6d. per share payable within two months. If they do not thus pay they are "not likely to receive anything." Though the prospectus is more modest than that of the original concern that it seeks to save, inasmuch as it only refers to £15,000 as the net profits for the first year, and £29,000 for the second, it guardedly mentions without making any promises, that "a dividend of 22 per cent. per annum on the preference and 15 per cent. per annum on the ordinary shares would, if the whole capital were issued and fully paid, amount to £13,905." The prospectus says that the works, including equipment, were valued as a going concern in December, 1911, at £28,377, but as our readers know, the factory has long been closed, and it is stated that the machinery and plant have been "kept cleaned and oiled during the period the factory has been closed," and these assets are practically in the same condition now as in 1911. At the meeting, reported on page 826, reference is made to "a certain quantity of obsolete machinery." It is stated that arrangements have been made for opening the works, administration and management have been reorganised, a British works manager with experience with a rival concern has been engaged. The chairman at the Metalite meeting stated that he came from the Osram Works. It would be interesting to know in what department and in what capacity he was engaged. The premises are said to be of sufficient area to enable the manufacture of 2½ million drawn wire metal-filament lamps to be produced per annum, but for the first year after re-opening an output of one million lamps, and 1½ millions in the second year, are promised, with financial results mentioned above. We are assured that this factory and its equipment, which is being "kept cleaned and oiled," but which admittedly contains obsolete machinery, constitutes "one of the best and most complete works in this country, and . . . . should . . . . become one of the foremost all-British lamp works in the country." The purchase price payable is £70,104, which includes the 3s. 6d. per share, which shareholders in Metalite, Ltd., are entitled to claim. The prospectus before us also offers for subscription 8,000 7 per cent. profit participating cumulative preference shares of £1 each. We hope that the company may succeed. War-time is a factor in its favour, but it has much to live down.

Automatic Telephone Manufacturing Co., Ltd.—The share and transfer books are closed from 17th to 24th inst. for the purpose of preparing the dividend warrants on the 6 per cent. preference shares for the half-year ending 31st inst., on which date the warrants will be posted.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—A financial daily states that the directors have decided to pay a final dividend of 3 per cent. (at rate of 6 per cent. per annum) on account of dividend accrued on 6 per cent. cumulative preference shares.

Power-Gas Corporation, Ltd.—The report for the year ended September 30th, 1914, shows a total profit of £20,510, plus £3,549 brought forward. This is dealt with thus:—To reserve fund, £4,100; dividend at 5 per cent. per annum upon the ordinary shares, £12,481; carried forward, £7,479.

Continental.—ITALY.—A "Società Idroelettrica Anonima" has been formed at Marcellinara, Province of Catanzaro, Italy, for the construction and working of hydroelectric works. The capital is 50,000 lire, and the duration of the concern fixed at 30 years.

Blackpool, St. Anne's & Lytham Tramways Co.—The annual report states that the traffic receipts show a considerable decrease, caused entirely by the outbreak of war. At the end of July the prospects were better than last year, and had it not been for the war there is every probability that this year's balance-sheet would have been a most satisfactory one. Under these circumstances the trustees for the debenture-holders have decided to make no distribution of interest on the debenture stock. The traffic receipts were £29,571 (£35,284 last year), and out of this £5,790 (£6,895) was paid to the Corporation. Advertising and sundry receipts and rents receivable brought the net revenue to £24,637, as compared with £29,146 in the previous year. There was a saving of over £1,700 in expenditure, but the balance available for the profit and loss account is only £2,274, against £5,056 a year ago.

Stock Exchange Notices.—Application has been made to the Committee to allow the following securities to be quoted in the Official List:—

Victoria Falls and Transvaal Power Co., Ltd.—£650,000 5½ per cent. second mortgage debentures, Series "B," Nos. 11,441 to 18,940 (£100 and £20) (renewed application).

The undermentioned securities are to be quoted in the Official List:—

Consolidated Gas, Electric Light and Power Co. of Baltimore.—Further issue of 1,564,300 dols. common stock.

Marconi's Wireless Telegraph Co., Ltd.—Further issue of 222,688 ordinary shares of £1 each, fully paid (Nos. 1,250,000 to 1,472,683).

Montreal Light, Heat and Power Co.—Further issue of 1,800,000 dols. capital stock (Montreal certificates).

Electrical Securities Trust, Ltd.—The report for the year to November 14th, 1914, to be presented at the meeting at Edinburgh on 15th inst., states (says the *Financial Times*) that the results, after charging all expenses and the interest due and accrued on the debentures, amounting to £2,500, show a loss of £858. No credit has been taken in the accounts for interests or dividends which may have accrued, and which have not been paid within the period of the accounts. The directors regret that they have been unable to dispose of any of the investments held by the Trust during the past year, and so enable the trustees for the debenture-holders to make a further distribution. Some of the investments have paid increased dividends during the year, but it is impossible to say whether these will be maintained, owing to the abnormal conditions created by the war.

Manx Electric Railway Co., Ltd.—The accounts for the year ended September 30th, after payment of debenture interest, show a credit balance of £3,325, which is to be carried forward.

Shawinigan Water and Power Co.—A dividend of 1½ per cent. on the common shares for the quarter ending December is declared.

New Issue.—The Metropolitan Railway Co. is inviting applications for an issue of £500,000 5 per cent. preference stock at 99 per cent.

Marconi International Marine Communication Co., Ltd.—The directors have declared an interim dividend on account of the current year of 5 per cent., equal to 1s. per share.

STOCKS AND SHARES.

Tuesday Evening.

STOCK EXCHANGE markets show noticeable strength, and it looks as though the year were going to end up with a good tone in most departments. The re-opening of the New York Stock Exchange, for dealings in shares as well as in bonds, sufficed to give a fillip to the whole of the American list; and this, in its turn, reacted upon other divisions. The Paris Bourse is open, though there is not much trade going on between the French capital and London. One or two of the provincial Exchanges have started business again under shelter. Why London should be condemned to deal in the wet and cheerless mud of Throgmorton Street day after day is a matter with which the Treasury is chiefly concerned.

Negotiations were opened at the end of last week between the Chancellor of the Exchequer, the Stock Exchange and the banks, but resulted in nothing save further adjournment of the question. A far-reaching scheme is in course of evolution, however, which will probably enable the Stock Exchange to get going inside its own doors early in the New Year, when dealings will be permitted under such restrictive rules as will make it virtually impossible for the alien enemy to obtain money or to transact any sort of business in the London Stock Exchange.

The principal strength is displayed in American Rails and nearly all the mining shares. Amongst the latter, copper descriptions are especially prominent. Rio Tintos may be instanced, having come up from 49 to 56 within a week or so. The fear of a famine in chemicals, for mining work, is now disregarded, and gold mining shares are being run up day after day.

The London County Council brought forward its scheme for the electrical supply of the Metropolis just on the day when a fresh order from the Secretary of State insisted upon a further darkening of London streets. The L.C.C. met to-day (Tuesday) to consider its wide and somewhat complicated London and District Electric Supply Bill, 1915, which seeks to give control to a Central Authority, in connection with electricity supply over a far-flung area. Details of the scheme have been published here and elsewhere, but they have had no influence at all upon prices in the

electrical supply market. Business there is as quiet as ever; and, naturally enough, the new lighting order for London has not quickened interest in the shares.

St. James's have been done between 8¾ and 9 since we last wrote, and City of London Ordinary changed hands on the basis of 14½-15. There are a few sellers about of County Ordinary, but in other high-class shares there is scarcely a mention of quotations. Charing Cross City Undertaking Preference have given way a little, being now back to 4. Otherwise, prices are unchanged.

Animation is apparent in shares of the manufacturing group. British Westinghouse Preference developed further strength, and jumped up to 36s. 3d. Both the Edison & Swan issues are better, the fully-paid hardening to £2. A good deal of sympathy has been expressed with Mr. Thomas Edison at the fire which broke out at the end of last week and destroyed the main works of his Phonograph Company. The shares in this concern, by the way, are all in the hand of Mr. Edison himself, and are therefore not known in the markets. Electric Constructions are a little better at 11s. 6d. Cromptons remain at 5s. for the Ordinary and 11s. for the Preference. Not much interest is taken in General Electrics, of which the Ordinary continue at 11½ and the Preference at 10.

The Metropolitan Railway has just made an issue of 5 per cent. Preference stock, offered early this week at 99. The security, unlike that of the South-Western issue made for the purpose of electrification, is an irredeemable stock. According to the prospectus, there is plenty of margin for the interest. Jobbers are not anxious to make prices until the allotments appear, but, nominally, there is a small premium quoted on the stock. This issue had the effect of putting down the price of the Ordinary to 31½, a fall of ½.

Districts keep about 18½. Underground Electric Railways met with a little demand, because of the breakdown of the trams, which threw an enormous increase of temporary traffic into the omnibuses and tubes. Underground Electric Incomes hardened to 80¼; the fully-paid shares are £2, and the shilling shares stand about 6s. 3d. Those whose perambulations depend principally upon the omnibuses must have felt thankful at their lot when they surveyed the pitiful crowds which waited for the trams that did not move. The seriousness of the breakdown was seen in the time that it took to get the full service re-started. London United Tramways Debenture stock is supposed to be in the neighbourhood of 55, but to get a bid for it is not an easy matter. London and Suburban Tractions are 5s., 10s. and 75 for the Ordinary, Preference and 4 per cent. Debenture respectively.

The following is a list of prices of representative stocks and shares in various electrical markets:—

HOME ELECTRICITY SUPPLY COMPANIES.

Brompton Ordinary	8⅜	Kensington Ordinary	7½
do. 7 per cent. Pf.	8¾	London Electric	1½
Charing Cross Ordinary	4¾	do. do. 6 per cent. Pf.	5
do. do. do. 4½ Pf.	4½	do. do. 4 Deb.	89½
do. do. City Pf.	4	Metropolitan	3
do. 4 Deb.	86½	do. 4½ per cent. Pf.	4½
Chelsea	4⅝	do. 4½ Deb.	91½
do. 4½ Deb.	91½	do. 3½ Deb.	81½
City of London	14⅝	St. James' and Pall Mall	9
do. do. 6 per cent. Pf.	13	do. do. 7 per cent. Pf.	6⅝
do. do. 5 Deb.	115	do. do. 3½ Deb.	83
do. do. 4½ Deb.	98	South London	3
County of London	11½	South Metropolitan Pf.	1½
do. do. 6 per cent. Pf.	11½	Westminster Ordinary	8½
do. do. 1st Deb.	99	do. 4½ Pf.	4⅜
do. do. 2nd Deb.	97		

MANUFACTURING COMPANIES.

Brit. West. Pf.	1⅛	Electric Construction	11/6
do. 4 Deb.	72	do. do. Pf.	1
do. 6 p. lien	98	Gen. Elec. Pf.	10
Callenders	11½	Henleys	18½
do. 5 Pf.	4½	,, 4½ Pf.	4⅜
do. 4½ Deb.	97½	,, 4½ Deb.	97½
Edison & Swan, £3 pd.	8/-	Telegraph Con.	36⅞
do. do. fully pd.	2	Castner-Kellner	2¹¹⁄₁₆
do. do. 4 Deb.	60		
do. do. 2nd Deb.	60		

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pf.	104	Gt. Northern Tel.	29½
do Def.	22	Indo-European	57
Chili Telephone	7	New York Tel 4½	97
Constantinople Tel.	4½	Oriental Tel. Ord.	2
Cuba Sub. Ord.	8½	do. Pf.	1⅛
do. Pf.	15½	Tel. Egypt Deb.	97
Eastern Extension	11½	United R. Plate Tel.	6
do. 4 Deb.	94	do. Pf.	5
Eastern Tel. Ord.	122½	West India and Pan.	1½
do. 3½ Pf.	71½	Western Telegraph	12⅝
do. 4 Deb.	96	,, 4 Deb.	95⅞
Globe Tel. and T. Ord.	10¼		
do. Pf.	12½		

FOREIGN TRAMS, &c.

Anglo-Arg. Trams 1st Pf.	4½	Bombay Electric Pf.	11
do. 2nd Pf.	4½	do. 4½ Deb.	96
do. 4 Deb.	86½	Mexico Trams.	45
do. 4½ Deb.	95½	do. 5 per cent. Bds.	70
do. 5 Deb.	88½	do. 6 per cent. Bds.	70
Brazil Tractions	68	Adelaide Sup. 6 per cent. Pf.	5⅞
		do. 5 Deb.	100½xd

The Melbourne Electric Supply Company is taking steps to increase its capital by £300,000, with Debenture stock for £25,000. The Company's profit rose to £43,804, as compared with £39,930, and the Ordinary shares again get 10 per cent. dividend. The Adelaide Electric Supply has also issued a fine report this week: the Ordinary shares receive 7 per cent., and the profits show substantial increase.

In the foreign group, the British Columbia Electric Railway Company's report has had virtually no effect upon the prices of the stocks. The company maintained its 8 per cent. dividend in respect of the past year, but proprietors are warned that there may be reduction in the near future. The Deferred is 100, and the Preferred and Preference stocks 95. The balance-sheet shows the company to be in a strong position, so that holders can face with equanimity whatever diminution in the distribution the directors may decide upon for the time being. The Shawinigan Company has declared its regular interim dividend of 1½ per cent., and the Pennsylvania Water and Power announces a dividend of 1 per cent. on the common shares, also for the past three months.

The really unsatisfactory spot in connection with foreign companies remains in Mexico. In that country, the situation seems to go from bad to worse, the position becoming more hopeless, if possible, every week. In the circumstances, most of the bonds and shares of the traction undertakings are well-nigh unsaleable—a lamentable condition of affairs, rendered the more so by the sharp improvement which is taking place in certain others of the foreign group. Brazilian Traction Common shares, from 50, have now risen to the neighbourhood of 63. For the material recovery from the lower price, readers of these notes who are interested will have been prepared by the hints dropped from time to time as to the shortage of stock. This, coupled with improvement in Brazilian exchange, has been largely instrumental in driving up the price; and, on the week, there remains a rise of 4 points.

Indo-European Telegraphs were lowered £1 to 57, but it is doubtful what the real price actually is. The company's cables run through the thick of the trouble; from Emden to Berlin, for instance, thence to Warsaw, on their journey to the East. Probably the company has an arrangement with one of the Eastern undertakings whereby its messages go over the latter company's lines at present. The Eastern group is firm, and Western Telegraphs have gone up 7s. 6d. to 12⅝.

Between the prices of Western Ordinary shares and Eastern Telegraph stock there lurks a trifling anomaly. Both companies occupy splendid financial positions, but the next Eastern dividend will no doubt include the bonus always declared at the fourth quarter of the year, making 3½ per cent., whereas the Western Company has already paid its dividend and bonus, making the full 7 per cent. Yet Eastern Ordinary can be bought at 125½, while Westerns cost nearly £13 a share, although, reasonably, the positions should be reversed.

New York Telephone Bonds are rather better, in consequence of the boomlet in American rails. West India and Panama hold their improvement, and Anglo-American Telegraph Deferred rose to 22. Constantinople Telephone shares are called 4¼. The Company has issued a notice stating that, in view of the present circumstances of war, the interest on the 6 per cent. Obligation Bonds must be postponed. The telephone service, however, is being maintained in Constantinople, under the direction of the British staff. Marconis are a better market than they have been of late, the price hardening to 1¹⁵⁄₁₆, with Canadians advancing in sympathy to 4s. and Americans to 9s. 6d.

The India-Rubber, Gutta-Percha and Telegraph Works has declared a dividend of 5s. per share, free of tax, making 5 per cent. for the year on the Ordinary shares. The report shows a net loss of £18,922 but the directors recommend to the shareholders the bold policy of taking £50,000 from the reserve, in order to pay the dividend on the Ordinary shares, justifying this course by the statement that the main causes of the trouble are, it is believed, at an end. Another interesting dividend announcement is that of Chadburn's Ship Telegraph Company, where an interim distribution at the rate of 6 per cent. per annum is to be made on the Ordinary shares.

Armament shares show very little change. The rubber market is uncertain, dulness giving way to rather more cheerful conditions and then re-asserting its control over the market in see-saw style. In most of the leading shares a fair amount of business is passing.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	
		£	£		£	£		Inc.
Bath	Dec. 9	2,846	— 154	49	46,936	— 46	..	..
Blackpool-Fleetw'd	,, 12	1,133	+ 29	49	38,893	— 5,018	8	..
Bristol	,, 11	31,704	+3,078	50	421,904	+25,155	30·5	..
Chatham and Dist.	Dec. 3	3,812	+ 412	48	46,425	+ 1,635	14·98	..
Cork	,, 10	1,833	— 112	49	24,187	— 192	9·89	..
Dublin	,, 4	22,089	+2,891	49	283,205	+18,729	54·25	..
Hastings	Nov. 25	3,066	— 193	..	..	— 3,028	19·3	..
Lancashire United	Dec. 9	5,675	— 517	49	79,814	— 8,256	42	..
Llandudno-Col. Bay	Nov. 27	613	— 10	52	15,616	— 2,057	6·5	..
Tyneside	Dec. 9	2,005	+ 161	24	14,263	+ 2,112	11	..
Anglo-Argentine	Dec. 9	208,050	−24,362	50	2,636,330	−91,875	..	..
Auckland	Nov.	19,391	+8,894	21	104,518	+12 264	25·42	1·05
Calcutta	Dec. 12	16,228	−1,663	..		+ 2,180	..	..
Kalgoorlie, W.A.	Sept.	2,864	..	29	28,980	..	..	..
Madras*	Nov. 30	3,146	— 158	49	40,715	+ 1,628	..	..
Montevideo	Nov.	27,081	−3,450	..	..	..	..	..
Dublin-Lucan Rly.	Dec. 4	444	— 16	22½	3,306	— 29	7	..

* Two weeks.

RECENT ADVANCES IN ELECTRICAL CRANE AND LIFT DESIGN.

[COMMUNICATED.]

One of the most apparent features at the present day with regard to electrical engineering is the specialisation which has ensued as a natural outcome of the wide diversity of purposes for which electric power has shown itself to be available, and an outstanding case in point is to be found in the way in which the application of electricity to the problem of crane and lift operation has developed both as regards the motor itself and the control apparatus for regulating the current. The subject is a vast one, and no attempt will be made in the present notes to completely cover the ground. It is, however, of interest to examine one or two ways in which the requirements of this service have developed special applications and modifications of electric design, and this will be the purpose of the present notes.

It will be found that such specialisation has extended not only to the switching appliances for crane control, which is a feature to be at once expected, but it has also had a radical effect upon the requirements imposed upon the motors which have to operate the lifts. At the outset, it will be interesting to briefly outline the salient features of this development. Considering first of all the direct-current motor, it has been found that the ordinary series, shunt or compound-wound motor was not altogether suitable in its standard form for the special requirements of crane and lift work, as this is very largely intermittent, and consequently the conditions of load are such that an adjustment has been found necessary in the relative relations of copper and iron in the motor. Hence crane-rated motors are, as a rule, lighter than the ordinary machine designed for continuous service; and, moreover, it will usually be found that the copper in the circuit is greater in proportion to the iron than in the ordinary type.

It will be found that among modern manufacturers, for instance, Messrs. Mather & Platt, Ltd., the design of crane motors has had considerable attention and ingenuity devoted to it, as will be seen from fig. 1, which

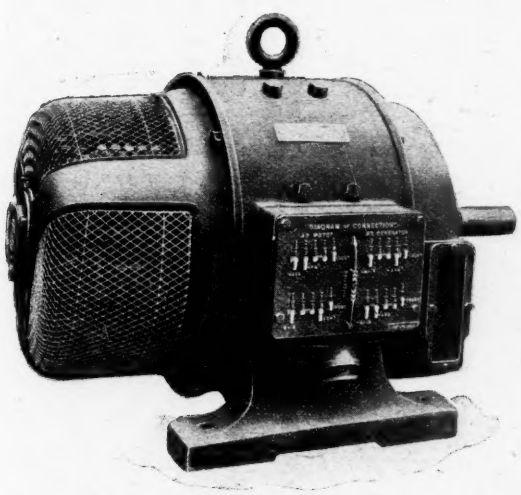


Fig. 1.

shows a standard direct-current crane motor of their latest type. It will not be out of place to enumerate some of the special features embodied in this design, as it has only been adopted after an extended period of experiment. The combination of a ball bearing at the commutator end, with a bush bearing at the driving end in actual practice, has more than justified its adoption. Not the least practical advantage derived by this method is the centralisation of the commutator which prevents sparking and other commutation troubles. Further, by having the bush bearing of extra length with duplicate oil rings, a steady drive is obtained, which is especially valuable where gears are employed.

As is clearly indicated in fig. 1, a considerable amount of care has been expended in order to reduce, what is in many instances a complication, into a very simple matter; as, by means of the diagram on the terminal cover and the simple arrangement of the connections, it is possible for the most unskilled attendant to make or alter the connections correctly. This is a very valuable feature when one considers the endless complaints and troubles caused through unsightly connections and main leads. As every user is aware, one of the greatest sources of weakness is to be found in the brush gear, but it is claimed that in the latest system by which radial acting box-type brushes are employed, all troubles in this respect have been overcome—a statement borne out by users all over the world who have given the system an extended trial. At no time during the lengthy period (more than 30 years) which this firm have been manufacturing electrical machines has more attention been paid to the insulation of the machine itself than at present, as it is fully recognised that not only for crane work, but in all cases, success depends solely upon the quality of the insulation and the care which is expended upon its application.

Fig. 2 illustrates the type of motor for use in dusty and damp atmospheres, which is therefore specially applicable to foundries and ironworks. An extremely interesting feature of this design is the type of commutating end cover adopted,

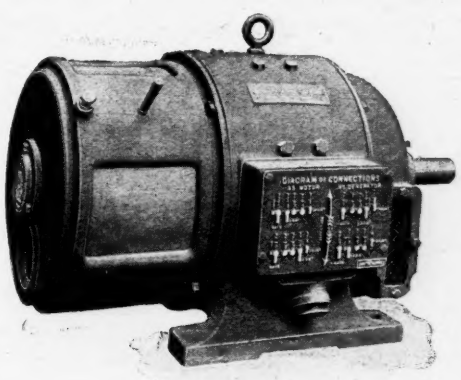


Fig. 2.

whereby it is possible to examine the brush gear with one movement of the encircling ring. The latter is so constructed as to protect the interior of the motor from dust and dirt, and is sufficiently massive to withstand the rough handling to which cranes and their motors are subjected.

It will be noticed that apertures are arranged in the end covers, so that pipes may be connected, thus allowing a supply of clean cool air to enter the interior of the motor and this is of assistance where cranes are driven by stationary motors. The features outlined in connection with fig. 1 are equally applicable to this design.

An important point in connection with crane motors is the intermittent application of very heavy overloads, and in the earlier designs of motors this was frequently a source o trouble owing to sparking on the commutator, due to displacement of the neutral axis owing to armature reaction This has led in recent times to the adoption of the interpole motor with commutating poles, which ensure sparkless running on all loads up to 100 per cent. overload. In the motors made by the firm just mentioned, heavy overloads can be given momentarily without sparking by virtue of the interpole construction, and they are, therefore, especially valuable where the load is irregular. Moreover, commutating poles enable the motor to be made reversible without altering the position of the brushes, and permit of a wide range of speed variation when this is required.

It is, of course, a difficult matter to design a test specification for a crane motor which will adequately meet all the conditions of service, inasmuch as these conditions themselves vary very largely according to the actual work which the crane or lift has to do. For light, quick-running lifts, for example, the load might be very short and frequent, while for traversing motors on a gantry crane it is probable that the time during which heavy current is

applied in relation to the time during which the motor is idle might be fairly considerable, and hence, although a quarter-hour rating is usually applicable to crane motors, it must be borne in mind that with increased relation of copper to iron there is less total mass of iron to be heated by the C^2R losses, and, therefore, there is more danger of a continuous load warming up the motor excessively than in the ordinarily designed motor. Hence a variation on the above test which might fittingly be applied would be after a steady running to give, say, double the load for 25 minutes while the machine is still hot, the temperature tests being taken between these two running tests.

Messrs. Laurence, Scott, Ltd., have developed a special type of winding for crane motors which requires a slight modification in the design of the controller, but which is very useful for easy acceleration when this is desired. In this case the field magnets are wound with something in the nature of double the number of turns that are usually put upon them, and arrangements are made so that when the motor reaches top speed half the windings are shunted, thus cutting out half the field currrent. It will be seen that on the lighter loads the surplus excitation increases the torque very considerably and decreases the speed, so that at half current from 30 to 60 per cent. extra torque is obtained at each step but the last, on which the series is shunted. Therefore, considerably better control is obtained with the use of the same amount of main resistance as in the ordinary motor, or alternatively, for the same degree of control a smaller resistance can be used. There are also other advantages in connection with this arrangement which may be summarised. Where the lowering speed of the crane is checked by making the motor generate on to a resistance, it is evident that with the shunted type of field the control can be obtained with a smaller generating current, and, therefore, there is considerably less danger of momentary sparking at the commutator when the controller handle is brought over to the braking position, due to the heavy rush of current which would otherwise ensue. Moreover, with this type of winding about half the full-load current is required for a dead slow lifting and lowering motion, as compared with ordinary windings, where something like full-load current is necessary. The advantage of the arrangement is that with this disposition of the windings no extra connections are required between motor and controller, as is the case when separate starting coils are used on the first step and cut-out for full speed. This greatly facilitates working operations. It may be argued that the shunting of part of the field winding in this way involves waste of current at full load, and that, therefore, the efficiency of the motor would be brought down in this way. As, however, the crane motor operates for considerable periods at half or three-quarters load or less, it is evident that the saving of current on these low loads due to the stiffening of the field more than compensates for the slight loss which would not exceed 5 per cent. due to the shunt operation on the top speed. This is, therefore, a most important advance in the design of crane motors.

Another point with regard to Messrs. Laurence, Scott's crane motor, which is illustrated in fig. 3, is that it is fitted with ball-bearings, and has also a solenoid and centrifugal brake gear, to which reference will be made in a further paragraph. Its great feature, however, is that it has a self-contained outer bearing. For pinion drives of any size it is most desirable to have such an outer bearing. This is becoming more and more recognised, and, of course, a single ball-bearing with an overhung pinion is not entirely good practice. When it becomes necessary to provide an outer bearing, ball bearings have great advantages, and the strains are so much reduced on them that they become thoroughly good practice. Endeavours have been made to provide motors with self-contained ordinary plain bearings and the usual ring lubrication, but the difficulty is to get out a practical scheme that allows the spur-wheel to come into the required position without interfering with the oil-box and fixings for the third bearing. The length also with an outer bearing is excessive. Ball bearings, of course, are very much shorter, and as there is no trouble with an oil-box, the bracket fixing for the outer bearing can be swung round to any position, so that a standard construction can be adopted which enables the spur-wheel to be fixed in any position, either at the side, at the top, or at the bottom. This will be clear from the view.

As far as alternating currents are concerned, the difficulty with regard to crane service is that synchronous motors are out of the question from the point of view of starting and stopping, while the induction motor, although simple from the point of view of control, does not with efficiency give any very great flexibility of speed, as in the ordinary types the running speed of the motor is a function of the frequency of supply, with a slight loss of speed dependent on the load due to slip. Where, however, the work is not too intermittent, that is to say, where the running speed is maintained at some considerable time interval as, for example, on long lifts, there are some possibilities for the application of alternating current, more especially if some of the newer forms of winding are used. An interesting example of this is the "Cascade" induction motor, made by the Sandycroft Foundry Co., Ltd., by means of which, in one form of the construction, two running speeds can be obtained, without the use of complicated control arrangements. In appearance the one-speed cascade motor is very similar to the ordinary wound-rotor type with the slip-rings left out, and one quarter of the rotor conductors omitted. The stator winding is connected in parallel, and, in addition to the main terminals, tappings are connected to it. The rotor winding is so connected, that it can simultaneously produce two magnetic fields of different numbers of poles. In the 12-pole rotor, for example, the stator is wound so that the supply current produces in it an eight-pole field. This acts on the rotor so as to induce in it current producing a field of the same number of poles, together with a supplementary field of four poles. This four-pole field produces a back electromotive force in the rotor winding, limiting the current to that required, and it, at the same time, generates induced currents in the stator winding. The points of maximum potential of these induced currents in the stator winding correspond to the position of the tapping connections, and by connecting the starting resistance of these points, the current and starting torque can be controlled, or the speed regulated in exactly the same way as with a slip-ring motor. The difference between the cascade type and the ordinary slip-ring type may be explained as follows. In the ordinary type the stator acts on the rotor, and there the inductive action stops, starting torque and speed regulation only being obtained by connecting resistances to the rotor windings. In the cascade type the rotor, by means of the supplementary magnetic field, reacts inductively upon the stator, reflecting back to it part of the energy received therefrom and the starting and speed regulating devices are connected to the stator, not to the rotor. For the two-speed type, slip rings are necessary. The stator windings carry only primary currents when the machine is running at the higher speed, but when running at the lower speed they carry in addition secondary currents induced by the action of the second rotor field. This rotor winding is of the plain barrel type, similar to those of the ordinary slip-ring machines, but as regards the method of connection, the windings form a closed circuit, and a certain number of coils are tapped into this closed circuit, and are provided at their free ends with slip rings. The arrangement of the windings is such that when the slip rings are short-circuited the current induced in the rotor gives only one number of poles, the machine behaving under these circumstances exactly like an ordinary slip-ring motor. When, however, the slip rings are open-circuited, a small number of the rotor conductors become inoperative and the currents in the rotor then produce two numbers of poles, the second of which acts upon the stator and causes the motor to run at a different speed. For example, a machine wound to run at eight-pole and twelve-pole speeds carries eight-pole windings. In order to start it, the switch connected to the slip rings in the ordinary way is gradually short-circuited, and the machine then behaves as an ordinary slip-ring motor. If the speed is to be reduced, the slip rings are open-circuited, and the short-circuiting switch mounted on the side of the motor and connected to the stator winding is closed. The rotor then reacts upon the stator and the machine runs at twelve-pole speed, the operation being reversed when it is required to raise the speed from the lower to the higher

one. While the machine is slowing down, this acts as a generator and returns energy to the line.

A great advantage of this system is that it is never necessary to break the main circuit except when the motor has to be totally stopped, and hence the whole of the operations can be achieved without sparking. Where two definite speeds are practically necessary for crane work, and especially where the running can take place at relatively long periods, it is a most suitable method of control, and where used on long lifts the losses during acceleration are reduced to nearly half that which would be obtained when using an ordinarily wound induction motor. In such cases, instead of mounting the short-circuiting switch on the side of the machine, the controller is connected with the tappings. When starting, the stator controller is first brought into operation, and the machine speeds up to its lower speed. Under these conditions the slip-ring controller is then brought into operation, and the motor then runs up to the higher speed. This method of operation is exceedingly simple, and there is a further advantage in that when starting, the cascade motor is capable of exerting a larger starting torque than when operating on the slip-rings. For a given input the motor at a lower speed develops 40 to 50 per cent. more torque than when running on the slip-rings, and the most economical method of operation is therefore to start with the maximum amount of energy required during the hoist, and to run up the speed with high acceleration up to the two-thirds speed. Above this speed the slip-ring controller comes into operation, and for the same energy input acceleration is reduced. The efficiency with this system of control is therefore large, and important advantages are obtained without the complications involved in some of the ordinary systems. Moreover, the cost of the arrangement is only small compared with that of the more complicated systems. The cost of a two-speed-wound motor is only a little over that of an ordinary slip-ring motor with one speed, and the further additional cost is only that of the stator controlling gear. As the amount of energy to be dissipated in resistances is only about half the loss with single-speed machines the sizes of the controlling resistances are much reduced. By changing over two of the leads of the stator circuit reversal of the direction of the motor is effected. The motors can be fitted with a

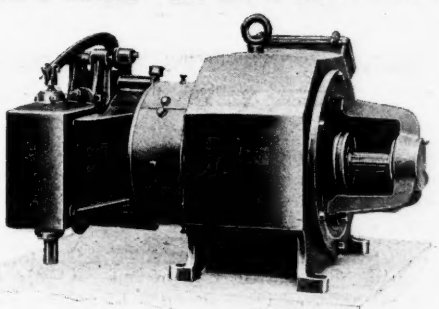


Fig. 3.

vertical shaft arrangement if necessary, and they can be built either ventilated or totally enclosed. For intermittent service, such as for cranes, lifts, and similar purposes, motors can be rated for an hour at 50 per cent. above their normal outputs, it being understood that by intermittent service is meant that the intervals of work and rest are of equal duration, the former not extending beyond a few minutes at a time. Either liquid or metallic switches can be utilised for starting the motor against half or full torque without undue heating, and are designed to start motors against full load torque when taking only full-load current.

While dealing with the motor equipments, the question of adequate braking comes prominently into consideration, and with electrically-operated cranes, some form of solenoid brake is usually fitted. Fig. 3 shows a special type of solenoid and centrifugal brake for series-wound crane motors which represents the latest practice in this portion of the subject. As will be seen, it is arranged for fixing on to the end bracket of the motor, and it is so proportioned that it will hold considerably over the full load even if the motor is fitted with the very efficient gearing which is now customary in connection with crane and lift work, and will deal with the full horse-power of the motor. The motor shown has also a centrifugal brake attachment which is found to be of considerable advantage in connection with lifting motors, although for traversing and slewing motors for crane service the solenoid brake only is found to be sufficient. In the case of series-wound motors, particularly when lowering heavy loads, but also in lifting light ones, there is some danger of too high speed being attained when the controller is put hard-over, while when lowering on a heavy load in compound-wound machines, even with speed-limiting shunt coils there is also the danger of excessive speed, although this is avoided when running light by the shunt coils. When lowering, however, even with moderately efficient gearing the motor will generate, and this generating current in the series winding will possibly nullify the effect of the shunt winding. Another point against the omission of a purely mechanical brake even on shunt-wound motors is that there is always a liability that the motor may be disconnected from the mains so that it cannot generate back on to the line, and, therefore, it may be said that for lifting motors the centrifugal type of brake is a most desirable adjunct. In the case considered, the brake drums for lifting motors where the heaviest wear occurs are made of steel, although for slewing and traversing motors where only the inertia of the lifting parts has to be absorbed by the brakes, cast-iron drums may be employed. In order to secure a tight fit of the drum on to the shaft equal to a hydraulic press fit, and at the same time to secure ease of removal of the drum at any time when this is desired, the method is adopted of splitting the boss into halves, and tightening these halves on to the shaft by means of a coned collar. The solenoid brake straps are lined with phosphor-bronze and provided with adjustments for taking up wear, although between steel and phosphor-bronze the wear is not very great. The brakes are pulled in chiefly by the pressure of a compression spring, although the weight of the arm and the solenoid also help the action to a certain extent. Adjustment is provided for the centrifugal brake by means of rectangular steel springs, and an adjusting nut by which more or less tension can be put on the springs to keep the brake shoes from flying out and touching the external drums.

(To be continued.)

CALCULATIONS RELATING TO ELECTRICAL CONDUCTORS.

[COMMUNICATED.]

In a general survey of the divers sections of the electrical industry of to-day, it would appear that most people who either manufacture, or make use of, electrical apparatus, at some time or other have to handle calculations relating to the sectional area and weight of conductors. Handicapped as we are by an antiquated outfit of measurement standards, the units of which have little or no cohesion or interrelation, it is not easy to work such calculations without considerable expenditure of time and pains. Frequently, too, the cumbrous British units have to be used in conjunction with the metric system, and the combination for some only serves to make confusion worse confounded. For instance, copper strip may be ordered with the dimensions given in fractions of inches, in mils, or in millimetres. The weight is perhaps stated in pounds, and the size in millimetres. Cables may be ordered in terms of square inches, square millimetres, or even circular mils; and in strands made up of wires drawn to any one of three gauges, the standard (S.W.G.), the Birmingham (B.W.G.), or the American Brown and Sharp (B. & S.). Of these three gauges, only the first shows any sign of being constructed in a well-balanced practical manner, in that the various sizes are to some extent uniformly progressive. Naturally this, the standard gauge, is the one most widely used, yet there are people who, from some weird lack of reason, use even the B. & S. gauge. The whole of the former can be memorised without difficulty, but the B. & S., well, hardly ever. For finer wire than, say, No. 26, it may be necessary to go to four places of decimals;

the B. & S. gauge, however, runs to four places even in large trolley sizes like No. 3/0 (·4096″), in which case it is scarcely practicable, and certainly unnecessary, to obtain such accuracy in drawing.

All these cases serve to emphasise the chaos of the present state of affairs, and the need for reform. Customs and usage seem to militate successfully against such reform, and the only alternative is to adapt oneself as well as possible to the present conditions pending their amendment. In order to do this, the writer has for some time recorded and accumulated some simple figures relating to conductors, which are useful on occasion in the workshop and office. They are based upon the following :—

	For copper.	For aluminium.
1 sq. in. section weighs	11·5625 lb. per yard	3·48 lb. per yard
,, ,,	12·6447 lb. per m.	3·805 lb. per m.
,, ,,	20,350 lb. per mile	6,125 lb. per mile
1 sq. mm. section weighs	31·54 lb. per mile	9·49 lb. per mile

Then to obtain weight per yard, per metre or per mile, for square, rectangular, or irregular section of strip, the area in square inches or square millimetres is multiplied by one of these constants, *e.g.*—

sq. in. area × 3·48 = weight per yard of aluminium.

These figures not only prove useful in ordering quantities of material, but serve as a check upon it when delivered. A yard of copper strip can be taken from a batch, and weighed. If the result differs from the calculated weight, the section s probably smaller in gauge, or larger, than it should be.

In the case of round wire, having the diameter given in mils (·001 in.), the constants are based upon the formulæ :—

1. Weight per 1,000 yards of copper = $D^2 \times ·7854 \times 11·5625 \div 1{,}000$ (where D = diameter of single wire in mils) = $D^2 \times ·00909$, or $D^2 \div 110$ (in pounds).

2. Weight per mile of copper = $D^2 \times ·7854 \times 20{,}350 \div 1{,}000{,}000 = D^2 \times ·016$, or $D^2 \div 62·5$ (in pounds).

For aluminium the figures obtained should be multiplied by ·301, as expressing the difference in weight. In the strands given in the following table, allowance is made for extra weight due to twist or lay, over and above that of straight wire.

For wire and strands : (D = diameter of wire used, in mils.)

	Copper.	*Aluminium.*	
1 wire	$D^2 \times ·00909$	$D^2 \times ·00274$	lb. per 1,000 yards.
3 strand	$D^2 \times ·0278$	$D^2 \times ·00835$	,, ,,
7 ,,	$D^2 \times ·065$	$D^2 \times ·0195$	,, ,,
19 ,,	$D^2 \times ·176$	$D^2 \times ·053$	,, ,,
37 ,,	$D^2 \times ·343$	$D^2 \times ·103$	,, ,,
61 ,,	$D^2 \times ·565$	$D^2 \times ·170$	,, ,,
91 ,,	$D^2 \times ·844$	$D^2 \times ·254$	,, ,,
127 ,,	$D^2 \times 1·177$	$D^2 \times ·354$	,, ,,
169 ,,	$D^2 \times 1·567$	$D^2 \times ·4717$	,, ,,
1 wire	$D^2 \times ·016$	$D^2 \times ·0048$	lb. per mile.
3 strand	$D^2 \times ·049$	$D^2 \times ·0148$	,, ,,
7 ,,	$D^2 \times ·114$	$D^2 \times ·034$	,, ,,
19 ,,	$D^2 \times ·310$	$D^2 \times ·093$	,, ,,
37 ,,	$D^2 \times ·604$	$D^2 \times ·182$	,, ,,
61 ,,	$D^2 \times ·995$	$D^2 \times ·308$	,, ,,
91 ,,	$D^2 \times 1·485$	$D^2 \times ·447$	,, ,,
127 ,,	$D^2 \times 2·07$	$D^2 \times ·623$	,, ,,
169 ,,	$D^2 \times 2·76$	$D^2 \times ·831$	,, ,,

With the aid of a slide rule, and using the above constants, any desired weight of copper, or aluminium, may be quickly, and, for all practical purposes, accurately found. As those familiar with a slide rule know, D^2 is found by inspection, and a simple multiplication completes the operation, provided only that due regard is paid to the position of the decimal point, when recording the result.

Again, one has occasion to find the required size of strand in cases where the area in square millimetres is given. This can be expressed as—

$$\text{Size of wires in strand} = \frac{\sqrt{\text{area in sq. mm.} \times 31·54}}{\text{a constant depending upon number of wires.}}$$

The division of 31·54 by the constant comes out as follows :—

For	
Single wire	1,971
Three-strand	665
7 ,,	285
19 ,,	103
37 ,,	54
61 ,,	32·6
91 ,,	21·8
127 ,,	15·7
169 ,,	11·75

Then, given the square millimetre area, and suppose it is proposed to use a 37 strand, the size of each wire (in mils) would be :—

$$\sqrt{\text{Area sq. mm.} \times 54}$$

e.g., 150 sq. mm. in 37 strand = $\sqrt{150 \times 54} = \sqrt{8{,}100} = 90$ mils, *i.e.*, 371·090 in., or, say, 37/13 S.W.G.

If the result gives a larger wire, or a smaller one, than is suitable for the purpose, the number of wires must be increased (say 61), or decreased (say 19), and the new size calculated according to the above. These figures are near enough, for all pratcical purposes, to mathematical exactness, if the result is taken to the nearest mil, or, where possible, to the nearest standard gauge size. It is preferable, for several reasons, to adhere as far as possible to gauge sizes, and it will often be found that when one strand produces an odd size of wire by the above method, if another strand is tried the wire comes out quite near to a standard gauge number. It is scarcely necessary to add that this formula applies both to copper and aluminium, since no question of weight or conductivity enters into the case. As already indicated, a slide rule is extremely useful, and, accompanied by formulæ similar to those shown, will afford a quite appreciable saving of time and trouble to anyone engaged on electrical or other engineering calculations. When more exactness is requisite one can always work right through step by step, and obtain the result to any number of decimals, but for all ordinary practice a ready reckoner constructed on the lines indicated is a great help. One can adapt other work in a similar way to the same end, and it is a good rule when making calculations to tabulate results for future use, because so often, sooner or later, the same conditions recur and call for the same set of calculations, or at the least another set on identical lines.

Finally, if desirable such tables can be embodied in the form of curves, and in this shape are easily accessible for reference, provided that the curve is plainly marked. Many people publish curves showing this or that, especially in technical papers, which hide more information than they disseminate. In fact, some writers seem to adopt the rule : "If one wishes to give nothing away, show it in graph form, and give no information in plain facts or figures."

ELECTRICAL ACCIDENTS IN MINES FOR THE YEAR 1913.

According to the reports of H.M. Inspector of Mines, during the year 1913 there occurred in the coal mines of Great Britain 15 electrical accidents resulting in 16 deaths, while 50 non-fatal accidents resulted in injuries to 51 persons, but of these only 42 of the accidents caused injuries to 43 workmen, which disabled them for more than seven days. Altogether there were 1,220 fatal accidents which caused 1,753 deaths, so that the percentage of deaths due to electrical accidents is a little over 0·9 per cent. There were, however, no fewer than 177,189 persons injured, so that the proportion of non-fatal electrical accidents is still less, being only about 0·024 per cent., and considering the great development of electricity in mines it certainly cannot be said that it has increased the danger to workmen employed. Still, one could wish there were no accidents due to electricity ; as a rule, with proper care and attention these are preventable, and while electricity is looked upon as "dangerous," it is worth noticing that 45 fatal accidents were caused *by machinery*, and 1,322 considered as specially dangerous.

As regards the accidents, they were in nearly all cases due to electric shock caused by the person coming in contact with a defective cable or other "live" part not efficiently protected or "earthed."

Four fatal and ten non-fatal accidents occurred in Scotland. Of the fatal accidents, one caused the death of a "drawer" at Kenmairhill Colliery, where three-phase alternating current at 400 volts, 25 cycles, is supplied by the Clyde Valley Power Co., and is used for pumping, hauling and coal cutting. In the No. 2 Rise section of the Virtuewell seam, where the accident happened, it was used

for coal cutting only. Until the present regulations came into force the cables were single core and bitumen insulated, but unarmoured, and these at the time of the accident were being replaced by a three-core armoured cable. In that part of the pit in which the accident occurred the new cable was in place, and was almost ready for connecting up.

There were some drawers and miners on the back shift clearing the faces for the coal-cutters, and it was one of the drawers who was killed. This drawer was working for a brusher, and, as it was food time, he told his employer he was going to have some food. It was customary to go to the haulage lye for it, and in the present case he was going there with a tub. No one saw what occurred, but a lad on his way from the shaft saw the body lying, and he returned to the shaft bottom, where the electrician and fireman cut off the current and hastened in-bye. Deceased was found lying on his back grasping one of the cables in his right hand, and the front of two of his fingers was burned away. Artificial respiration was tried, but the body was nearly cold, and, after about 10 minutes' trial, it was seen to be of no use. It is thought that he had drawn the cable aside to get the flask, and that in so doing had grasped a part which was without effective insulation and was killed.

Each of the three cables was 7/14 S.W.G. bitumen-covered and protected with jute braiding. Just at the part the man had grasped the braiding had become frayed, and at some time in the past it had evidently been taped over to prevent further fraying. The drawer, who was killed, may have cracked or broken the bitumen inside the taping when pulling the cable, or more probably, it was broken there before, and had been merely taped over instead of having been properly insulated before being taped. Mr. Masterton, who investigated this accident, had another joint similar to this opened and found waterproof taping only on top of badly-cracked and hardened bitumen. Other two parts opened had been properly repaired. The cables had been in this colliery for at least three years, and probably for five; no history of them had been kept, and they had been shifted many times. The tapings were old, and neither the person who did them nor the time they were done could be traced.

The electrician said he had examined the cables minutely eight or 10 days before the accident, and, as he and his assistant were in the section daily, they were seen daily, though not in detail. The place where the accident occurred probably looked all right, but the cables generally were as Mr. McIlhenny found them a few days before the accident, viz., exceedingly bad, and they should have been condemned by the electrician.

An accident occurred at Auchengeich Colliery, by which a motorman lost his life.

A turbine pump driven by three-phase alternating current at 440 volts, is placed near the shaft. In order to prevent the pump from going on "air" there is a contrivance contained in a cast-iron box for opening a switch which controls the running of the pump motor. The switch-box cover is secured by two screws. The contrivance was seldom in use, and at the time of the accident, *the switch was out of order*, as one of the contacts was burned out. Deceased was employed at a motor haulage situated about 25 yards away from the pump. He left his place and went to the pump room, and in examining the switch-box referred to, the cover of which was off, he received a fatal shock. As the switch was not in use the connection should have been cut, rendering the whole contrivance dead. The electrician in charge was held, in some measure, to blame for this neglect.

A fireman employed at the Broomrigg Colliery, received a fatal electric shock when working in the neighbourhood of a coal-cutter. The trailing cable was coupled up to the coal-cutter and the gate-end box, and the deceased was engaged in paying out the haulage rope. The machineman closed the switch in the gate-end box, but, as in doing so he received a shock, he at once opened it again. Going down the face he found the deceased apparently dead. Two other men near the machine had also received shocks. The motor was supplied with three-phase current at 440 volts. To account for the accident the management put forward the theory that the deceased had received a shock by making contact with a faulty part of the trailing cable, but the trailing cable had been examined by the electrician on the surface on the morning of the accident, and had just been brought down the pit. For these reasons the theory of the management seems doubtful.

When the machine was examined on the surface, a spot was found in the plug-box where undoubtedly arcing had taken place between the conductors and the frame, and it was considered most probable that this defect caused the accident. The earthing system was defective, as proved by the shock obtained from the gate-end box. The machine was not earthed direct to the surface, but to the delivery pipes of a pump in the seam. The machine man stated that he had received slight shocks on previous occasions.

An earthing system must be completely effective, otherwise it is worse than useless, as it engenders a feeling of security where there is none. In this instance there was little doubt the accident was due to a defective earthing system. Since the accident the apparatus has been brought into conformity with the electricity regulations in all respects.

An accident occurred at Lochore Colliery, by which a roadman lost his life.

The accident occurred on a fairly dry level haulage road opposite a switch-house. There were two girders across the entrance to this switch-house, acting as bearing girders for three of the roadway girders. The place was lighted by electric glow lamps, supplied with current at 500 volts through 3/20 rubber-insulated unarmoured cable, the current being tapped off two phases of the alternating-current power supply. The lighting cables passed under the bearing girders mentioned, which had sagged owing to a severe crush on the road, until they were bearing hard on the cables, one of which had become thereby abraded. This caused the two bearing girders and the three girders resting on them to become "live," a circumstance which became known to several men, including deceased, and in consequence an electrician was sent for to cut off the current. There was a switch in the house just mentioned, but none of the men on the spot, although one of them was an oversman, knew exactly how it worked. As the electrician was a long time in coming, the oversman decided to go to assist in the search for him, and left deceased to guard the place and prevent any person touching the girders. Almost immediately deceased was seen to fall backwards, when apparently searching for something between the girders with his lamp. Artificial respiration was tried at once, and kept up until the arrival of a doctor on the spot an hour later, but life was pronounced to be extinct. Although deceased was apparently guilty of great carelessness, it is to be regretted that the oversman was not able to switch off the current.

At the inquiry the jury returned a formal verdict, and added three riders to the following effect, viz. :—

1. That the present high voltage for lighting the pit should at once be reduced.
2. That in exposed and dangerous places cable stronger mechanically than the cable in use should be adopted.
3. That officials of the mine should receive such instructions as would enable them to switch off current in cases of emergency.

Of the 10 non-fatal accidents underground, these are briefly referred to by the Inspector as follows :—

1. A machineman had his finger burnt owing to the failure of the insulation of a trailing cable.
2. A machineman at the same colliery had his right arm burnt owing to the failure of the insulation of a cable.
3. A machineman was examining a trailing cable when the insulation failed. He received slight burns about the eyes.
4. A coal-cutting machine was at work, but the commutator-cover had not been securely fixed, and, in consequence, it became displaced, when it came into contact with a bar set to the roof. The cover touched the brushes, and a machineman received slight burns from the resulting arcs. This accident seems to have been due to pure carelessness.
5. Another accident which must be placed in the same category resulted in unconsciousness for a time. A fall of roof occurred which severed the tubes carrying medium pressure lighting cables. Instead of cutting off current at once, as required by Regulation 131 (*e*) the electrician attempted a repair with the current on. He asked the man who was subsequently injured to hold the tube, and whilst they were twisting it to get it straight the cable drew out of a lampholder and touched the inside of the tube, which was not earthed for the moment, in consequence of the break. Fortunately, the man holding the tube was standing on dry ground, and escaped with no further injury than that stated. I cannot understand a skilled man allowing men working for him

to take risks of this kind, and it is very fortunate indeed that the consequences were not more serious.

6. A motor attendant was replacing a fuse controlling five motors, aggregating 125 H.P. on a 500-volt D.C. circuit. By some means the controller of a 40-H.P. motor had been left in the running position, so that as soon as he attempted to put the fuse home, it blew, and he received injuries to the eyes. It would have been better had a switch been in position on the out-bye side of the fuse box, so that the current could have been cut off when fuses were being replaced. This would have complied with Regulation 128 (*b*), and I am glad to say the change was made.

7. Two men were drawing a concentric trailing cable forward when the insulation failed, and one man received burns on the hand from the resulting arc.

8. A machineman was drawing forward a concentric trailing cable when the insulation failed, and there was an arc which severely burned his left arm and forearm. Some days previously a stone had fallen on the cable and sparks had been seen, but a subsequent test with lamps failed to reveal any defect. It seems a great pity that a more thorough test was not made in this case with higher pressure.

9. A motorman was replacing a fuse, when it blew and burnt his right arm. A switch was provided against the fuse-box for cutting off current from the fuse-box when fuses were being replaced, and the injured man alleges that this switch was open. I think, however, he must have been mistaken.

10. A man was crawling over a concentric cable supplying current to a coal-cutting machine, when the insulation failed and he received burns on the abdomen.

The fact that six of these accidents were due to failure of insulation of cables shows how important it is that this matter should have careful and skilful attention. We have often referred to the difficulty of maintaining good insulation in mines, and the necessity of employing competent electricians who understand "insulation" and "earthing," and we regret to read the Inspector's remarks referring to the careful examination of cables: "This is sadly neglected at some mines."

There were no fatal accidents on the surface, but an apprentice electrician was burned on his hands while measuring the distance between terminals through failing to remember that they were "live," and another young apprentice touched a live wire carrying current at 500 volts with another piece of wire in order to ascertain whether it were really "live." Fortunately he escaped with a slight burn on the left hand. As the Inspector says, comment is needless.

(*To be concluded.*)

Electric Lighting of Trains in U.S.A.—At the annual convention of the Association of Railway Electrical Engineers at Chicago, in October, it was stated that more than one-half of the cars in use by the principal American railroads were electrically lighted. The number of electrically lighted railroad cars had increased from 11,017 in 1911 to nearly 19,000 in 1914, an increase of about 72 per cent. Greatest growth had been shown by the straight-storage-battery and axle-generator system, while the number of head-end installations had increased by about one-third the percentage of axle-lighting installations. Nearly 260,000 cells of lead storage battery were in use in the car-lighting field, compared with 32,000 cells of nickel-iron battery, although the number of cells of the latter had increased nearly six times in the last two years.

The report of a Committee on axle-lighting equipment showed that, taking into account certain railroads operating in the northwest section of the United States which favoured the head-end system of lighting, 23,477 cars, or 84 per cent. of the electrically-lighted cars in the United States, Canada and England, were lighted by the axle-generator system. Of the remaining 16 per cent. about nine-tenths could be converted to axle-lighting without loss. Data were given in the report concerning operating costs in the United States and England, and particular attention was called to the high cost of maintaining the dynamos as compared with all other parts of the equipment. Battery maintenance, for example, was found to amount to only about one-half that for generators.

Mr. K. R. Hare, chief electrician of the Northern Pacific Railroad, described the system of head-end lighting from an axle-driven generator mounted in the baggage car, which had been developed by that railroad. Experiments in this direction began in 1909, and the latest type of unit, installed this year, comprised a 20-KW., six-pole, commutating-pole, compound-wound, 80-volt Gould generator, which ran at speeds of from 300 R.P.M. to 2,100 R.P.M. A Morse silent chain drove the generator from a countershaft. This outfit had already run 40,000 miles without a failure. The maximum lamp load was 100 amperes, and the generator was in operation about 80 per cent. of the time. Cells of battery were placed beneath the postal car, the dynamo car, the sleepers and the observation car. The head-end axle-lighting system presented a number of advantages, including the absence of excessive heat in the baggage or express car, and the avoidance of terminal charging. —*Electrical World*,

TRADE STATISTICS OF SWITZERLAND.

IMPORTS.

The following figures of the imports of electrical and similar goods into Switzerland in the year 1913 are taken from the recently issued official trade statistics; the figures for 1912 are added for purposes of comparison, and notes of increases or decreases are given. A diminution in Germany's imports is shown in a number of lines, but it will be noticed that this coincides in many instances with a general decrease, and therefore does not indicate a decline in Germany's relative share. The poor participation of Great Britain is apparent:—

	1912. Francs.	1913. Francs.	Inc. or Dec. Francs.
Electric cable not insulated.—			
From Germany	37,000	42,000	+ 5,000
,, France	3,000	17,000	+ 14,000
,, Other countries ...	1,000	1,000	—
	41,000	60,000	+ 19,000
Electric cable insulated with rubber or paper.—			
From Germany	145,000	139,000	— 6,000
,, Great Britain ...	5,000	3,000	— 2,000
,, Other countries ...	19,000	16,000*	— 3,000
Total	169,000	158,000	— 11,000
* Includes Belgium 5,000 fcs.			
Cable ditto covered with lead.—			
From Austria	68,000	—	— 68,000
,, Germany	2,000	4,000	+ 2,000
Total	70,000	4,000	— 66,000
Cable ditto covered with lead and iron-armoured.—			
From Germany	No details	25,000	—
,, Great Britain ...		25,000	—
Total	6,000	50,000	+ 44,000
Cable insulated with rubber or paper and covered with textiles.—			
From Germany	314,000	194,000	— 120,000
,, Other countries ...	15,000	15,000*	—
Total	329,000	209,000	— 120,000
* Includes Italy 9,000 fcs.			
Cable ditto covered with lead.—			
From Germany	32,000	14,000	— 18,000
,, Austria	57,000	188,000	+ 131,000
,, Other countries ...	2,000	15,000	+ 13,000
Total	91,000	217,000	+ 126,000
Steam boilers of iron or steel.—			
From Germany	2,624,000	1,880,000	— 744,000
,, France	226,000	264,000	+ 38,000
,, Belgium	10,000	27,000	+ 17,000
,, Great Britain ...	25,000	122,000	+ 97,000
,, Other countries ...	45,000	28,000	— 17,000
Total	2,930,000	2,321,000	— 609,000
Dynamo-electric machines and electric transformers.—			
From Germany	1,361,000	1,341,000	— 20,000
,, France	45,000	81,000	+ 36,000
,, Italy	38,000	89,000	+ 51,000
,, Great Britain ...	16,000	15,000	— 1,000
,, Other countries ...	19,000	17,000	— 2,000
Total	1,479,000	1,543,000	+ 64,000
Hydraulic and wind motors and pumps.—			
From Germany	727,000	618,000	— 109,000
,, Austria	13,000	31,000	+ 18,000
,, France	43,000	54,000	+ 11,000
,, Italy	28,000	18,000	— 10,000
,, Great Britain ...	14,000	4,000	— 10,000
,, United States ...	16,000	7,000	— 9,000
,, Other countries ...	7,000	14,000	+ 7,000
Total	848,000	746,000	— 102,000

	1912. Francs.	1913. Francs.	Inc. or Dec. Francs.
Steam engines, locomobiles, steam turbines, etc.—			
From Germany	437,000	791,000	+ 354,000
,, France	41,000	28,000	— 13,000
,, Great Britain ...	71,000	23,000	— 48,000
,, Other countries ...	6,000	9,000	+ 3,000
Total	555,000	851,000	+ 296,000
Gas, petrol, benzine, etc., motors.—			
From Germany	306,000	286,000	— 20,000
,, France	123,000	148,000	+ 25,000
,, Italy	36,000	15,000	— 21,000
,, Great Britain ...	11,000	15,000	+ 4,000
,, United States ...	35,000	35,000	—
,, Other countries ...	20,000	11,000	— 9,000
Total	531,000	510,000	— 21,000
Accumulators, batteries, electrodes.—			
From Germany	244,000	342,000	+ 98,000
,, Austria	77,000	45,000	— 32,000
,, France	31,000	33,000	+ 2,000
,, Other countries ...	8,000	9,000	+ 1,000
Total	360,000	429,000	+ 69,000
Insulators mounted.—			
From Germany	93,000	149,000	+ 56,000
,, France	2,000	2,000	—
,, Other countries ...	3,000	1,000	— 2,000
Total	98,000	152,000	+ 54,000
Electric meters.—			
From Germany	970,000	963,000	— 7,000
,, France	104,000	78,000	— 26,000
,, Italy	10,000	12,000	+ 2,000
,, Great Britain ...	3,000	7,000	+ 4,000
,, United States ...	5,000	6,000	+ 1,000
,, Other countries ...	17,000	5,000	— 12,000
Total	1,109,000	1,071,000	— 38,000
Telegraph and telephone apparatus.—			
From Germany	348,000	515,000	+ 167,000
,, Belgium	297,000	224,000	— 73,000
,, Great Britain ...	19,000	24,000	+ 5,000
,, Sweden	44,000	55,000	+ 11,000
,, Other countries ...	16,000	54,000	+ 38,000
	724,000	872,000	+ 148,000

Note.—25 francs = £1..

EXPORTS.

The following figures show the exports of electrical and similar machinery from Switzerland in 1912 compared with 1913. The diversity of Switzerland's growing export trade is noteworthy :—

	1912. Francs.	1913. Francs.	Inc. or Dec. Francs.
Dynamo-electric machines and electric transformers of all kinds.—			
To Germany	2,837,000	3,471,000	+ 634,000
,, Austria	1,093,000	1,125,000	+ 32,000
,, France	3,756,000	4,174,000	+ 418,000
,, Italy	901,000	934,000	+ 33,000
,, Belgium	914,000	882,000	— 32,000
,, Great Britain	822,000	1,234,000	+ 412,000
,, Russia	1,805,000	3,278,000	+ 1,473,000
,, Spain	1,410,000	2,080,000	+ 670,000
,, British India	280,000	182,000	— 98,000
,, Mexico	24,000	79,000	+ 55,000
,, Brazil	757,000	1,255,000	+ 498,000
,, Argentina	968,000	231,000	— 737,000
,, Other countries ...	1,459,000	1,428,000	— 31,000
Total	17,026,000	20,353,000	+ 3,327,000
Hydraulic and wind motors and pumps.—			
To Germany	1,223,000	1,149,000	— 74,000
,, France	848,000	1,028,000	+ 180,000
,, Italy	500,000	645,000	+ 145,000
,, Great Britain	480,000	554,000	+ 74,000
,, Russia	279,000	492,000	+ 213,000
,, Spain	468,000	1,151,000	+ 683,000
,, Japan	1,413,000	520,000	— 893,000
,, Canada	81,000	410,000	+ 329,000
,, Mexico	435,000	326,000	— 109,000
,, Brazil	558,000	120,000	— 438,000
,, Argentina	269,000	590,000	+ 321,000
,, Other countries ...	1,566,000	2,107,000*	+ 541,000
Total	7,999,000	8,520,000	+ 521,000

* Includes South Africa 359,000 fcs., and India 536,000 fcs.

	1912. Francs.	1913. Francs.	Inc. or Dec. Francs.
Steam engines, cranes, pumps, turbines, &c.—			
To Germany	1,743,000	2,206,000	+ 463,000
,, France	638,000	888,000	+ 250,000
,, Belgium	1,249,000	1,152,000	— 97,000
,, Russia	1,549,000	3,244,000	+ 1,695,000
,, British India	203,000	84,000	— 119,000
,, Japan	269,000	590,000	+ 321,000
,, Other countries ...	2,589,000	2,330,000*	— 259,000
Total	8,240,000	10,494,000	+ 2,254,000

* Includes Great Britain 651,000 fcs.

Gas, petrol, benzine, hot air, &c., motors.—			
To France	2,406,000	2,599,000	+ 193,000
,, Italy	1,979,000	1,181,000	— 798,000
,, Great Britain	770,000	569,000	— 201,000
,, Russia	862,000	1,337,000	+ 475,000
,, Roumania	315,000	716,000	+ 401,000
,, Egypt	1,039,000	599,000	— 440,000
,, Algeria and Tunis ...	458,000	346,000	— 112,000
,, Argentina	374,000	794,000	+ 420,000
,, Australia	301,000	155,000	— 146,000
,, Other countries ...	3,918,000	3,610,000*	— 308,000
Total	12,422,000	11,906,000	— 516,000

* Includes Brazil 448,000 fcs., Germany 717,000 fcs.

Electric meters.—			
To Germany	291,000	629,000	+ 338,000
,, Austria-Hungary ...	150,000	184,000	+ 34,000
,, France	465,000	635,000	+ 170,000
,, Italy	198,000	355,000	+ 157,000
,, Other countries ...	249,000	504,000*	+ 255,000
Total	1,353,000	2,307,000	+ 954,000

* Includes Great Britain, 181,000 fcs.

Steam, benzine and electric locomotives.†—			
To France	797,000	405,000	— 392,000
,, Algeria and Tunis ...	68,000	350,000	+ 282,000
,, Dutch E. Indies ...	157,000	41,000	— 116,000
,, Italy	130,000	—	— 130,000
,, Other countries ...	306,000	537,000*	+ 231,000
Total	1,458,000	1,463,000	+ 5,000

* Includes Turkey in Asia 158,000 fcs.
† Electric locos in 1912, £257,000; in 1913, none specified.

Electric cable not insulated.—			
To Germany	1,000	3,000	+ 2,000
,, France	24,000	5,000	— 19,000
,, Other countries ...	2,000	1,000	— 1,000
Total	27,000	9,000	— 18,000
Electric cable insulated with rubber or paper.—			
To Germany	9,000	25,000	+ 16,000
,, France	28,000	80,000	+ 52,000
,, Italy	58,000	38,000	— 20,000
,, Other countries ...	282,000	47,000	— 235,000
Total	377,000	190,000	— 187,000
Cable ditto covered with lead.—			
To Germany	42,000	8,000	— 34,000
,, Great Britain	34,000	43,000	+ 9,000
,, Spain	—	7,000	+ 7,000
,, Other countries ...	9,000	4,000	— 5,000
Total	85,000	62,000	— 23,000
Cable ditto, covered with lead and iron armoured.—			
To Germany	213,000	303,000	+ 90,000
,, Great Britain	432,000	393,000	— 39,000
,, France	6,000	14,000	+ 8,000
,, Egypt	1,000	12,000	+ 11,000
,, Other countries ...	13,000	11,000	— 2,000
Total	665,000	733,000	+ 68,000
Cable insulated with rubber or paper and covered with textiles.—			
To France	14,000	24,000	+ 10,000
,, Italy	65,000	123,000	+ 58,000
,, Great Britain	28,000	224,000	+ 196,000
,, Other countries ...	33,000	14,000	— 19,000
Total	140,000	385,000	+ 245,000
Cable ditto covered with lead.—			
To Germany	12,000	9,000	— 3,000
,, Great Britain	3,000	8,000	+ 5,000
,, Other countries ...	8,000	6,000	— 2,000
Total	23,000	23,000	—

Note.—25 francs = £1.

NEW PATENTS APPLIED FOR, 1914.

(NOT YET PUBLISHED).

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

23,269. "Process for the manufacture of metallic tungsten and its alloys." J. C. Butterfield. November 30th.

23,272. "Electric switches." J. H. Tucker & J. A. Crabtree. November 30th. (Complete.)

23,274. "Device for coupling together two or more servo-motors with any desired phase relationship." W. H. Riddlesworth. November 30th.

23,282. "Telephone instruments." Automatic Telephone Manufacturing Co., Ltd. November 30th. (Automatic Electric Co., United States.)

23,283. "Telephone receivers." L. Brown & C. Macintosh & Co., Ltd. November 30th.

23,292. "Electrical process for producing cyanides." J. E. Bucher. November 30th. (Convention date, June 25th, 1914, United States.) (Complete.)

23,293. "Electrical water-heater." S. le F. Varvel. November 30th. (Complete.)

23,314. "Electric heat-radiators." A. B. Neiman. November 30th. (Complete.)

23,321. "Control of switches for electric lighting or heating systems." Electric & Ordnance Accessories Co., Ltd., & J. Etchells. November 30th. (Complete.)

23,332. "Electrical (pen or pencil) lamp attachment." D. F. Lintine. December 1st.

23,339. "Contact-fingers for electric drum-type controllers and the like apparatus." O. B. Jacobsen. December 1st.

23,357. "Electric starters for use on motor-cars and the like." A. H. Midgley & C. A. Vandervell. December 1st.

23,359. "Limiting reactance coils." J. F. Peters. December 1st. (Convention date, February 5th, 1914, United States.) (Complete.)

23,366. "Controllers for electric motors." Igranic Electric Co., Ltd. December 1st. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

23,368. "Automatic regulating apparatus for dynamo-electric machines." V. A. Trier. December 1st.

23,379. "Controlling movement at a distance." Harle et Cie. December 1st. (Convention date, December 1st, 1913, France.) (Complete.)

23,380. "Telegraph and like signalling systems." T. B. Dixon. December 1st. (Convention date, December 5th, 1913, United States.) (Complete.)

23,392. "Insulated wire and electric-cable coupler." J. M. Dunkley. December 2nd.

23,420. "Incandescent electric lamp-holders." W. S. Johnston. December 2nd.

23,443. "Production of incandescent light from rare earths." G. F. Jaubert. December 2nd. (Complete.)

23,444. "Electric starting and illumination of motor-cars." L. Renault. December 2nd. (Convention date, December 2nd, 1913, France.) (Complete.)

23,445. "Heating elements." N. C. F. Cronholm, A. J. Hoog, & F. O. Nilson. December 2nd. (Convention date, December 3rd, 1913, Sweden.) (Complete.)

23,452. "Electro-deposition of iron." S. O. Cowper-Coles. December 3rd.

23,453. "Process for coating metallic or other surfaces with metals." S. O. Cowper-Coles. December 3rd.

23,454. "Coating metallic or other surfaces with metals." S. O. Cowper-Coles. December 3rd.

23,455. "Production of tinplates and tinplate substitutes by electrolysis." S. O. Cowper-Coles. December 3rd.

23,456. "Electro-plating metallic sheets." S. O. Cowper-Coles. December 3rd.

23,457. "Construction of electrolytic anodes." S. O. Cowper-Coles. December 3rd.

23,458. "Apparatus for coating sheets and plates in continuous lengths." S. O. Cowper-Coles. December 3rd.

23,459. "Apparatus for electro-plating sheets and other objects." S. O. Cowper-Coles. December 3rd.

23,481. "Electric lamps." P. Ramy. December 3rd. (Convention date, December 30th, 1913, Belgium.) (Complete.)

23,485. "Secondary batteries or accumulators." J. C. A. Ward & R. Pape, Ltd. December 3rd.

23,486. "Electric insulators." C. B. Burdon. December 3rd. (Siemens-Schuckertwerke G.m.b.H., Germany.) (Complete.)

23,495. "Electric resistance furnaces." G. Gmur-Zehnder. December 3rd. (Complete.)

23,496. "Manufacture of ductile tungsten." Gluhfadenfabrik Aarau Akt. Ges. vorm. Gmdr et Cie. December 3rd. (Convention date, January 15th, 1914, Germany.) (Complete.)

23,505. "Transformer connection for three-phase metal-vapour rectifiers." Allgemeine Elektricitats-Ges. December 3rd. (Convention date, December 3rd, 1913, Germany.) (Complete.)

23,513. "Automatic and semi-automatic telephone systems." Betulander Automatic Telephone Co., Ltd., & F. M. Ward. December 4th.

23,524. "Electric lamp fittings and the like." A. A. Schaschke. December 4th

23,544. "Electro-magnetic switches." British Thomson-Houston Co., Ltd. December 4th. (General Electric Co., United States.)

23,555. "Combined incandescent electric lamp and reflector." C. P. Lawson. December 4th. (Complete.)

23,563. "Electric ringing-apparatus or other mechanism having polarised electro-magnets." V. Cleuet & G. Bonneuil. December 4th. (Convention date, December 17th, 1913, Belgium.) (Complete.)

23,566. "Electrically-operated tabulating and like machines." C. A. E. A. Greene & British Tabulating Machine Co., Ltd. December 4th.

23,571. "Electric junction boxes." Appareillage Gardy Soc. Anon. December 4th. (Convention date, December 5th, 1913, Switzerland.) (Complete.)

23,572. "Frequency-changing transformers." T. Kujirai. December 4th. (Complete.)

23,577. "Method and means of fixing insulating-material on the surfaces of metallic walls of ships' cabins, refrigerating plant, and other structures." G. Lizieri. December 4th.

23,605. "Supports for electric lamps." G. S. Herne. December 5th.

23,628. "Magnetos and other electric generators." A. Keller-Dorian. December 5th. (Addition to 8,391/14. Convention date, December 6th, 1913, France.) (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

18,869. Electrolytic Devices suitable for use as or in the Construction of Meters, Switches, and other apparatus. W. B. Thorpe & Thorpe Meter Syndicate, Ltd. August 19th.

23,444. Electric Switches. J. H. Tucker & J. A. Crabtree. October 16th.

23,454. Apparatus for Electrolytically Cleaning Articles. E. le R. Couch. October 16th. (January 31st, 1913.)

25,915. Electric Switches. D. Adamson. November 12th.

25,991. Electric Line Selector Switches. I. H. Parsons. November 12th.

26,077. Music Transmitting Apparatus. J. J. Comer. November 13th. (November 13th, 1912.)

26,139. Automatic Equipoise or Stability Control Apparatus. F. C. R. Marks. November 14th. (H. Chapman.)

26,497. Electrically and Gas Heated Cooking Ovens. A. F. Berry. November 18th.

26,831. Means for use in Controlling the Temperature of Electrically-heated Cooking and Sterilizing Apparatus and the like. C. E. Hearson. November 21st.

27,360. Time-actuated Mechanisms. R. C. Griesbach & Venner Time Switches, Ltd. November 27th.

28,826. Alternating-current Electric Meters of the Induction Type. British Thomson-Houston Co., Ltd., & A. P. Young. December 13th.

1914.

133. Electric Lamps fed by Dynamo-electric Generators Driven by Irregular Actuating Means. F. Esteve. January 2nd. (January 4th, 1913.)

925. Electric Current Controllers and like apparatus. G. Ellison. January 13th.

5,243. Ships' Binnacles or the like. J. W. Mackenzie (B. A. Hand). February 28th.

8,138. Composition particularly suitable for Insulating Electric Conductors. T. J. Hadley. March 31st.

9,840. Automatic or Semi-automatic Telephone Exchange Systems. G. A. Betulander. April 21st. (April 23rd, 1913.)

10,707. Time Alternate-current Meters. Compagnie pour la Fabrication des Compteurs et Materiel d'Usines a Gaz. April 30th. (July 8th, 1913.)

12,659. Controlling Apparatus for Electrical Lifts and the like. A. W. Penrose & Co. & M. Owen. May 22nd.

13,291. Diaphragms for Sound Recording and Reproducing Devices such as Talking Machines. L. N. Reddie (Owen & Hewitt). May 30th.

14,342. Combined Insulating and Fastening Means for Railway and like Rails. W. R. Gorrell. June 13th. (April 20th, 1914.)

15,549. Printing Telegraph Apparatus. A. E. Alexander (Union Switch & Signal Co.) June 29th.

15,550. Printing Telegraph Apparatus. A. E. Alexander (Union Switch & Signal Co.). June 29th.

17,487. Receiving Systems for Radio Telegraphy or Telephony. G. O. Squier. July 23rd.

Gyrostatic Control.—In a paper read before the Institution of Engineers and Shipbuilders in Scotland on November 17th, Dr. J. G. Gray described a number of new gyrostatic devices for controlling moving bodies, such as torpedoes, and showed that they possessed marked advantages over those at present in use. The latter were effective only for short distances, but the new devices could ensure the maintenance of motion in a straight line for very long distances. Torpedoes thus controlled could also be steered by wires, but the author considered that the direction of torpedoes by wireless transmission was not practical at present, as the sending apparatus would have to be tuned to the receiving apparatus on the torpedo beyond the possibility of interference from without. Aeroplanes and airships capable of being steered and elevated or depressed, under the control of electrical action, could be devised, and would be useful for fighting Zeppelins.

Dr. Gray held that motor gyrostats would in the future play a great part in warfare, and urged that this country should take the lead in the scientific advancement of the subject.

Proposed New Cyanamide Works.—It is stated that the Prussian Minister for Agriculture is in negotiation with various circles for the purpose of providing a substitute in the form of calcium cyanamide and sulphate of ammonia for the present lack of supplies of Chilean nitrate. The imports of Chilean nitrate into Germany amount to about 900,000 tons per annum, of which 200,000 tons are required by the chemical industry and the balance of 700,000 tons by the agricultural industry. It is now sought to take action so as to provide for a large portion of this tonnage being ready for next autumn. The existing works—Knapsack, Baden Aniline and the Bavarian Nitrogen Works of Troptberg—are said either to be competing or co-operating in connection with certain schemes which are based upon the use of existing or prospective electrical powers for the purpose, and leading electrical groups seem to be participating in the preparation of the projects. The Siemens & Halske Co. is already interested in the Bavarian Nitrogen Works Co., which has just declared a dividend of 8 per cent. for 1913-14, as compared with 9 per cent. in 1912-13.